# MACHINERY

## *Design—Construction—Operation*

Volume 41 JANUARY, 1935 Number 5

**Great improvements in the design of machines and dies used in the die-casting process, as well as the better die steels and die-casting metals available, have made parts produced by this process suitable for an endless variety of applications. The leading article in February MACHINERY is the first of a series that will deal thoroughly with *Recent Progress in Die-Casting Die Design.***

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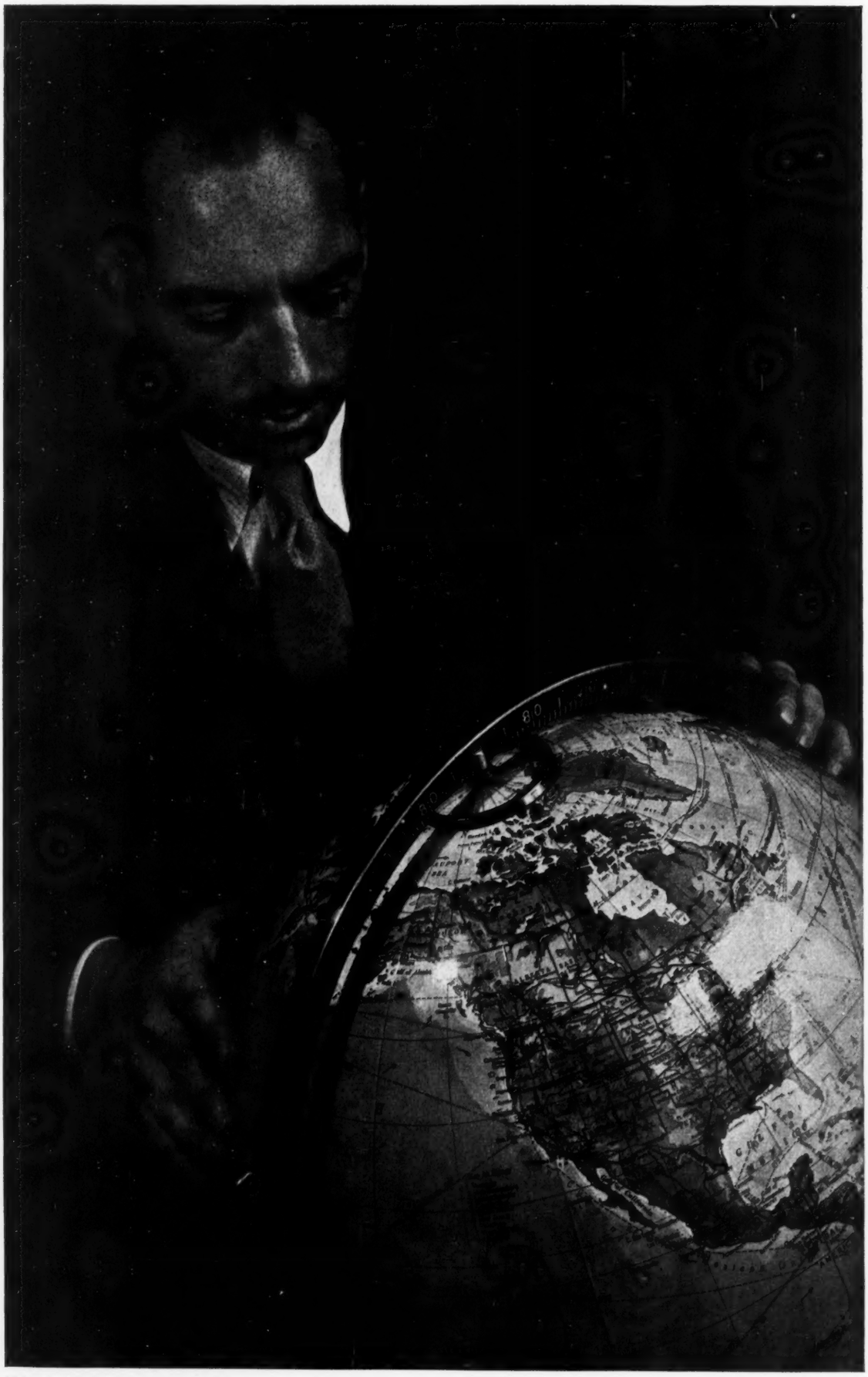

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MACHINERY

Volume 41 NEW YORK, JANUARY, 1935 Number 5

# *Modern Bearing Design*

## *How the Allowable Loads for Plain or Sleeve Bearings are Determined*

*By L. M. TICHVINSKY*
*Mechanical Division, Research Laboratory*
*Westinghouse Electric & Mfg. Co.*

A BEARING of any type should be designed to reduce both friction and the rate of wear to a minimum. Low friction results in higher machine efficiency, a low rate of wear, and longer bearing life. The development of bearings has progressed simultaneously with the improvements in machines, especially for high speeds and severe service. These bearing developments are the result both of theoretical investigations and of knowledge accumulated from the practical experience of designers and service men in many fields of industry.

During the last twenty or twenty-five years, the allowable unit bearing pressures have increased considerably, due mainly to improved lubricants, better methods of cooling, and improved bearing materials. The chemists and lubrication specialists have provided lubricants that will safely carry thousands of pounds on a very thin oil film without contact between journal and bearing. If we should compare oils made years ago with oils of today having the same viscosity, the lubricating properties of the older oils undoubtedly would be found to be inferior. The mineral lubricants are now more stable, on account of better refining technique

*Mr. Tichvinsky Measuring the Thickness of the Oil Film in a Bearing under Different Loads in the Westinghouse Research Laboratories*

resulting from improvement in the distillation of the crude oil, as well as of advancement in clay treatment. The new methods, making use of tube stills and solvent extraction processes, do not involve molecular distortion, which was always obtained by the old method of refinement. In addition to these improvements in the quality of lubricants, the safe performance of bearings has been further advanced by such treatment of oil in service as filtering and centrifuging.

Oils for bearings should be selected very carefully with reference to the class of service for which they are to be used. For example, high-viscosity oils have a low coefficient of friction at starting and a comparatively high value during motion, which should be considered in selecting oil for machines that are stopped and started frequently, in order to avoid excessive starting friction and to secure relatively small frictional resistance during motion.

**Maximum Pressures and Velocities for Different Classes of Bearings**

**These Values are Intended as a General Guide Only**

| Maximum Pressure, Pounds per Sq. In. of Projected Area | Maximum Velocity, Feet per Second | Application of Bearing | Remarks |
|---|---|---|---|
| 70 | 70 | Turbines; condensers; pumps. Journals 1" to 10" dia. | Ring-lubricated annular bearings |
| 100–130 | 4–20 | Generators; motors; condensers. Journals 2" to 16" dia. | Ring-lubricated annular bearings |
| 150 | 30–100 | Same as above | External cooling |
| 150 | 130 | Reduction gears; generators; marine turbines | Pressure-lubricated annular bearings. Oil cooler |
| 350 | 25 | Kingsbury thrust bearing | Pressure-lubricated oil cooler |
| 400 | 25–125 | Same as above | |
| 560 | 25 | Main bearing Diesel engines | Forced-feed lubrication. Oil cooler |
| 700 | 30 | Pin of Diesel engine | |

### *Cooling Lubricating Oils*

Close attention is being paid to the efficient cooling of lubricating oils by means of water and air coolers. The usual oil cooler for medium and large horizontal bearings consists of an oil coil submerged in a tank through which water is circulated. The Westinghouse standard oil cooler for thrust and guide bearings is composed of thin copper tube coils submerged in the oil surrounding the bearing. Cooling water is circulated through these coils. Water coolers are the most efficient; the temperature of the oil may be decreased from 10 to 30 degrees C. (50 to 86 degrees F.).

No metal-to-metal contact takes place during perfect lubrication, except at the moment of starting and stopping, when the oil may be squeezed out from the clearance space. Large bearings supporting heavy loads are usually equipped with a high-pressure oil-pump leading the oil underneath the journal in order to lift it at the starting and stopping moment and reduce torque requirements and wear.

The development of bearing materials by the metallurgist has accompanied the development of rotating machines in general. Many improvements have been made in connection with the properties, selection, and application of bearing bronzes and white bearing metals for different classes of service. For example, the thermal conductivity has been increased without affecting other physical properties of the metal. Better casting technique, with accurate temperature control, has also effected great improvements in bearing materials.

An interesting point was brought out recently in connection with babbitting practice. It was found that, for perfect babbitting of a bearing shell, it was necessary to have the babbitt in a fluid state from one to a maximum of five minutes in the heated bearing shell before it solidified. This short period of time was sufficient for a solid and perfect binding of metals, during which time diffusion of both materials took place.

### *Allowable Unit Pressures*

Allowable unit pressures depend upon the bearing design and workmanship, the class of service, the properties of the lubricant and of the bearing metal, and other factors. Assuming that an oil film is to be maintained, the problem in designing is to determine the maximum *safe* allowable pressure for a given lubricant and peripheral journal velocity. A modern method of procedure, as applied to high-class bearings, such as are found on steam turbines, generators, etc., will be referred to later. The accompanying table gives an approximate idea of the pressure and speed limits for several classes of babbitted bearings, but these are not absolute limiting values and are intended only as a general guide.

### *Use of Empirical Formulas for Determining Allowable Pressures*

It is the practice of some manufacturers to check bearing performance by means of an empirical formula, such, for example, as

$$PV = \text{Constant}$$

In this formula $P$ = pressure in pounds per square inch of projected area (projected area = journal length × journal diameter); $V$ = rubbing velocity of journal in feet per minute.

The constant for a given bearing and given operating conditions can be determined either for a given pressure and velocity or for an allowable range of pressure-velocity values. This constant, however, must be established by actual laboratory or service tests, because it is influenced by various factors, such as the properties and viscosity of the lubricant; velocity, pressure, characteristics of the bearing material, etc.

The relative importance of these factors also varies. For instance, where an oil film is maintained in a carefully designed precision bearing, the lubricant is very important, especially if the bearing operates continuously or for long periods. On the other hand, if there is considerable metallic contact, due either to frequent stopping and starting or to bearing distortion, the properties of the bearing metal are obviously of much greater importance than for the first condition cited. The great diversity in operating conditions and in bearing design and construction accounts for the fact that constants for empirical bearing formulas may range from 10,000 to 350,000 or more.

With the empirical formula previously given, all pressures are directly proportional to the velocity. According to another empirical formula which has been used

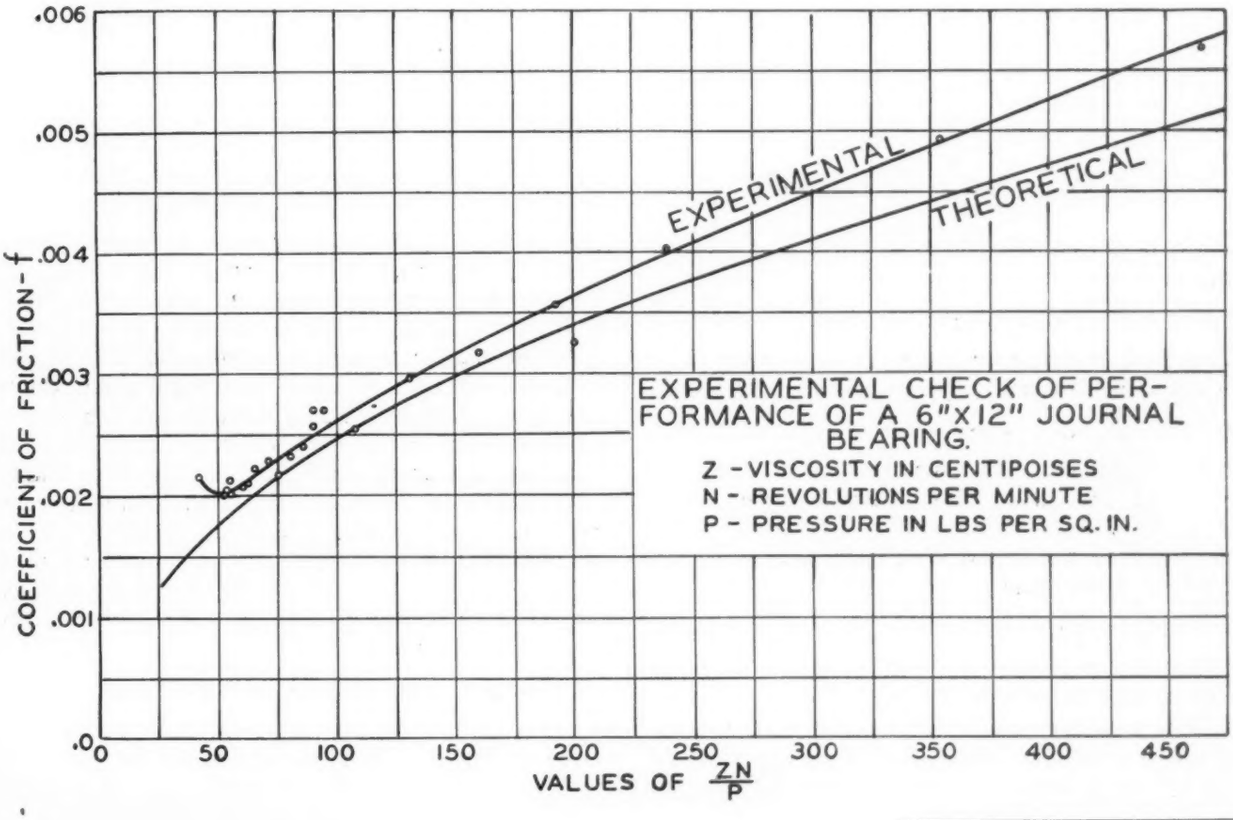
$$P = \text{Constant } \sqrt[3]{V}$$

In this case, the pressure increases with the cube root of the velocity. It is evident that constants for this formula will also vary for the reasons previously given. Constants ranging from about 15 to 16 have been used for bearings of electrical machinery, but, as pointed out, much depends upon the design of the bearing, the workmanship or finish, and the quality of the lubricant used.

### *Modern Procedure in Designing Bearings for Oil Film Lubrication*

In the design and construction of bearings for such machines as steam turbines, generators, motors, etc., it is especially important to reduce the frictional losses as far as possible. Such machines frequently are operating a large proportion of the time, so that the power losses in improperly constructed or lubricated bearings might be considerable. Consequently, it is essential for manufacturers of machines requiring large high-speed

*Fig. 1. Curves Representing Values of ZN/P, from which the Characteristic Number or Designing Value for a Given Bearing is Derived*



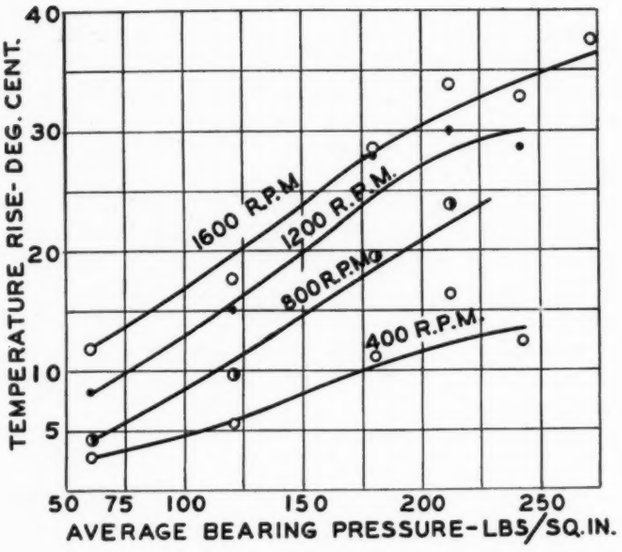



*Fig. 2. Average Temperature Rise of Bearing above Temperature of Oil in Bearing Reliefs at Different Speeds and Pressures*

bearings to minimize frictional losses, even though this involves considerable research and testing to determine the allowable values which may be used as a basis for a bearing design.

### *Establishing the "Characteristic Number" or Designing Value for a Given Bearing*

It is important to know what factors influence the coefficient of friction. If the absolute viscosity $Z$ of the lubricant expressed in centipoises is multiplied by the number of revolutions per minute $N$ and the product is divided by the pressure $P$ in pounds per square inch of projected area, then the quotient representing these three combined factors may, for practical purposes at least, be considered a function of the coefficient of friction. For example, if the viscosity were 13.5 centipoises, the speed 1850 revolutions per minute, and the pressure 250 pounds per square inch, then

$$\frac{ZN}{P} = \frac{13.5 \times 1850}{250} = 100$$

Now, if one or more of these three factors were changed during a series of tests, and if the coefficient of friction equivalent to each $\frac{ZN}{P}$ value were determined, a curve or series of curves could be plotted, as shown in Fig. 1. Suppose, for example, that the $\frac{ZN}{P}$ value is gradually reduced during the test run from, say, 450 down to 50 by lowering the speed and increasing the pressure (see curve, Fig. 1).

As the diagram shows, this reduction is accompanied by a decrease in the coefficient of friction down, in this particular instance, to a $\frac{ZN}{P}$ value of 50; then the coefficient of friction rises. This rise indicates that the oil film has partially broken down and that a value of 50 is too low for this bearing. It is evident, though, that this value should be as low as is consistent with safe operation, because the higher the $\frac{ZN}{P}$ value, the higher the coefficient of friction.

The hydrodynamical theory on which fluid lubrication is based gives a complicated expression for the value of the coefficient of friction $f$. This expression can be reduced for a known type of bearing to

$$f = \text{Constant } \frac{ZN}{P}$$

The constant depends upon many factors, as for example, type of bearing, leakage coefficients, oil film thickness, etc.

### *How is the Characteristic Number Established?*

By referring again to Fig. 1, it will be seen that the friction is lowest right at the point where it begins to rise, or at the danger point. What $\frac{ZN}{P}$ value or characteristic number, then, should be used in designing a bearing such, for example, as the one represented by the curve in Fig. 1?

The general answer is that the value upon which the design should be based must be far enough from the danger zone to provide a suitable factor of safety. Every lubricated bearing has an allowable range of these values. This range, representing stable lubrication, will vary with the ratio of clearance to diameter, the ratio of length to diameter, and the deviation of journal and bearing from true cylindrical forms. The elimination of minute irregularities in bearing surfaces from "running in" the bearing may affect the range of values somewhat, especially if the new surfaces are comparatively rough.

A characteristic number or $\frac{ZN}{P}$ value of, say, 75 for a certain bearing may indicate perfect lubrication, but be close enough to the region of a partial breakdown of the oil film to require careful

design, accurate machining, and proper lubrication of a bearing designed on the basis of this characteristic number. With another type or design of bearing or different operating conditions, a higher or a lower value might be preferable.

Fig. 1 shows both theoretical and experimental curves. The theoretical curve was computed on the basis of data and methods given in A. Kingsbury's paper, "Optimum Conditions in Journal Bearings," Transactions of A.S.M.E., 1931. The values for the experimental curve were obtained during performance tests of a 6- by 12-inch plain journal bearing. If changes in any of the three factors $Z$, $N$, or $P$ resulted in a combined value much below 50, bearing seizure would result. The main variables encountered in bearing design are the viscosity of the oil, speed, bearing dimensions, and load. Hence, the expression $\frac{ZN}{P}$ might be changed to include diameter $D$ in inches, length $L$ in inches, and total load $W$ in pounds (instead of the unit pressure $P$) as follows: $\frac{ZNDL}{W}$

### *Use of Bearing Curve for Preliminary Calculations*

A curve of the type shown in Fig. 1 is very useful for preliminary calculations, since with a given speed, pressure, and an assumed operating temperature and resulting viscosity, the coefficient of friction may be obtained easily, and then the total bearing losses $L$ can be found from the expression:

$$L = \frac{fWV}{K}$$

where $f$ = coefficient of friction;
$W$ = total load in pounds; and
$V$ = peripheral velocity in feet per minute.

Losses are in horsepower if the constant $K = 33{,}000$; in kilowatts if the constant $K = 44{,}300$; and in B.T.U. per second if the constant $K = 46{,}700$.

In some cases, where bearings operate under extreme service conditions, the oil film thickness is checked. The heading illustration shows the author measuring the thickness of the oil film in a bearing, under different loads, at the Westinghouse Research Laboratories. In ordinary commercial bearings, with a steel shaft and a babbitted shell, a film thickness above 0.00075 inch should be maintained if the speed is high, and a thickness not below 0.0004 inch in all other cases. (See G. B. Karelitz, "Performance of Oil-Ring Bearings," Transactions A.S.M.E., 1929.)

### *Rise in Bearing Temperature*

An increase in bearing speed or pressure, or both, will be accompanied by a rise in the bearing temperature up to a point where under normal conditions the heat is dissipated as fast as it is generated, so that further temperature rise is arrested.

An interesting series of tests was recently completed in the Westinghouse Research Laboratories, during which the variation of temperature was observed when speed and pressure were changed. (See paper on "Performance of Large Journal Bearings," by R. Baudry and L. M. Tichvinsky, presented at the annual meeting of the A.S.M.E., December, 1934, for detailed calculations of all bearing variables.) An experimental standard plain journal bearing 6 by 12 inches was loaded up to 275 pounds per square inch, the speed varied, and the temperature recorded by means of four thermo-couples symmetrically located. The thermo-couples were inserted in small holes drilled in the bearing shell to such a depth as to penetrate more

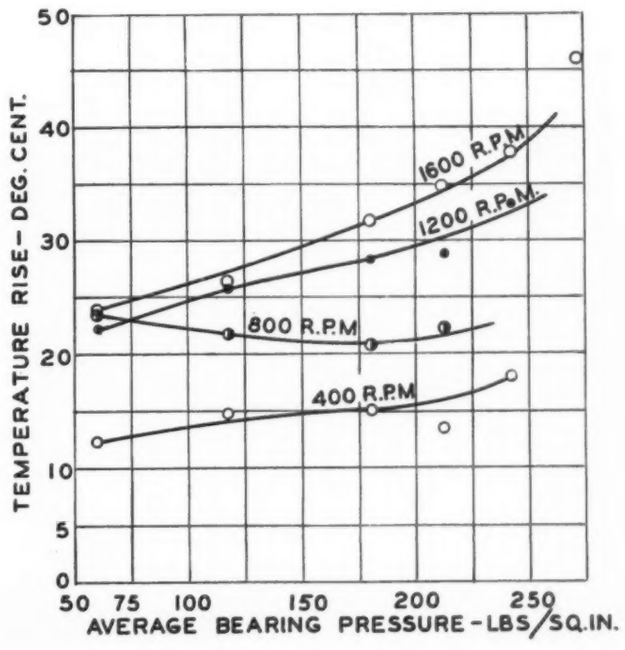



*Fig. 3. Average Temperature Rise of Bearing above Ambient or Surrounding Air at Different Speeds and Pressures*

than 1/8 inch into the babbitt. The lubricating oil under a head of two feet was led into the right and left bearing reliefs. The curves in Fig. 2 show the average bearing temperature rise above the oil temperature in the bearing reliefs. The curves in Fig. 3 show the temperature rise of the bearing above the ambient or surrounding air, resulting from different unit pressures and speeds.

If the temperature rise is excessive, vaporization and carbonization of the lubricant may occur, with lowering of the viscosity to such an extent that the oil film breaks down under the load. The allowable temperature rise above the temperature of the surrounding air will vary considerably, due to several factors, such as the viscosity and properties of the lubricant, the temperature of the surrounding air, and the heat-radiating capacity of the bearing which may, of course, be greatly increased by artificial cooling.

Most bearings operate at temperatures ranging from 90 to 120 degrees, and, as a general rule, bearing temperatures should not exceed 140 to 160 degrees F. These temperatures represent a rise of possibly 80 to 90 degrees, depending upon the air temperature. If this rise is over 100 degrees, it may be necessary to employ water cooling. In measuring temperatures, the thermometer should be placed in the lubricating oil if possible.

## A New Blast Mill for Cleaning Castings and Forgings

A new type of blast-cleaning equipment for use in cleaning castings and forgings has been developed by the W. W. Sly Mfg. Co., Cleveland, Ohio. The basic feature of this equipment is that it uses several times more abrasive grains in a given period of time than formerly, with a proportionate increase in the number of impacts on the surfaces to be cleaned. This large volume of abrasive is fed into the air stream from a high-pressure blower.

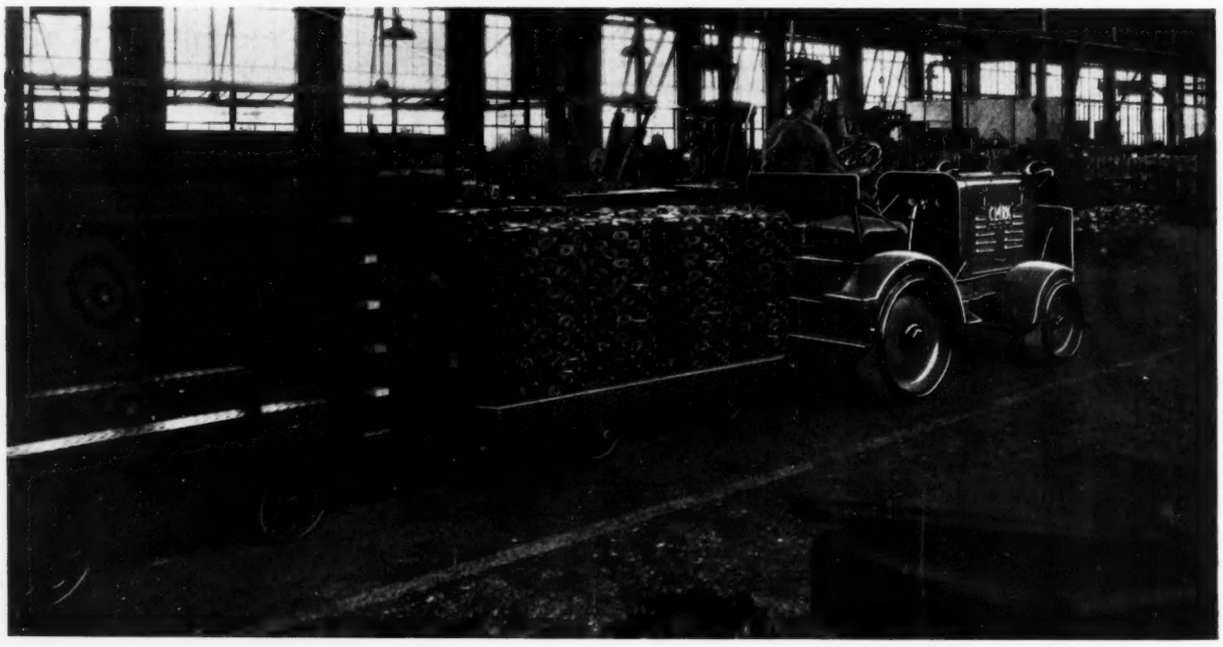
The first application of this blast principle is in connection with a combination tumbling mill and blast mill, the barrel of which has an inside diameter of 42 inches, and a length or depth of 36 inches. It revolves on an inclined axis. The design permits running the mill at low speed for delicate work and at higher speeds for other work, of which annealed malleable castings are a good example. The tumbling action can be combined with blast cleaning on a great variety of work, so that a tumbled and blasted finish is obtained in a single operation.

The barrel is perforated and surrounded by an outer shell, which receives the used abrasive and by means of a spiral flight, returns it to the upper end at every revolution of the barrel. Buckets fixed to the inside of the outer shell lift the abrasive and return it to a feed hopper above the blast nozzle.

* * *

The belief that production and consumption can by any amount of planning be brought to a balance while publicly created wealth flows unimpeded into private pockets, and private wealth is taxed to death to raise public revenues, is a chimera of the imagination, devoid of any mathematical basis.—*Commerce and Finance*

A 46-horsepower Industrial Tractor Built by the Clark Tructractor Co., Battle Creek, Mich., Known as "Clarktor-6," which is Claimed to Have a Pound of Draw-bar Pull for Every Pound of Tractor Weight. A Wide Range of Speeds is Available up to 18 Miles an Hour. Equipped with Self-starter, Generator, Battery, Electric Horn, Front Bumper Plate, Eye Coupler, Pneumatic Tires, and Lights to Facilitate Night Operation

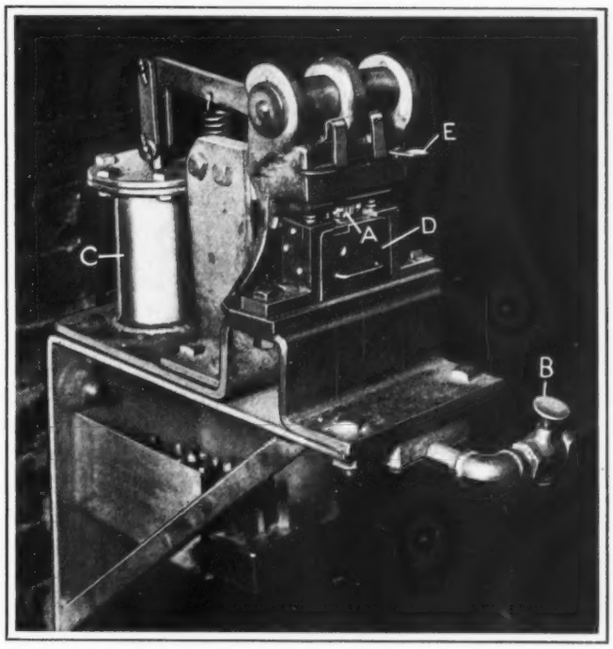


## Stamping Metal Tags for Identifying Locomotive Parts

By OLIVER HERBERT

When locomotives in need of repairs arrive at the Battle Creek, Mich., shops of the Grand Trunk Railway System, a small tin tag with a number stamped on it is attached to each part that is dismantled. Thus, as the parts go through the shops, they can be readily identified at any time, the same number, of course, being stamped on every tag used for a given engine. The tags are about 1 1/4 inches long by 1/2 inch wide.

It was formerly the custom to stamp these tags by hand, but as from 125 to 150 tags are usually required for one locomotive and there are three or four numerals and letters on each, the making of the tags by this method took considerable time. For this reason, the small air-operated machine here illustrated was built. This machine not only stamps the numbers, but also punches two holes in the tags and cuts them from the strip stock.




Small Machine which Rapidly Punches Metal Tags that are Used for Identifying Dismantled Locomotive Parts

The punches are mounted on a ram, as seen at *A*. The ram is moved downward one stroke each time that the operator depresses valve *B* to admit air into cylinder *C*. The ram is returned to the upper position by the action of coil springs. The operator feeds the tin stock into the machine from the front by hand.

At each ram stroke, the identifying numerals and holes are stamped on the portion of the stock that is beneath the punches; and at the same time, a shear in back of the punches cuts off the stock that was stamped at the preceding stroke. A fiber insert backs up the stock as the numerals are formed. The finished tags fall into drawer *D*.

The punches have a narrow slot across the front side which is engaged by sheet-metal part *E*, locking the punch to the ram. To release the punches, it is only necessary to withdraw part *E*.

* * *

Experimentation sometimes simply means trying things out before thinking them out.

## General Electric Co.'s Provisions for Unemployment

After more than four years of experience with the unemployment insurance plan adopted in June, 1930, the General Electric Co., with the approval of its employes, has made certain changes in this plan, placing it on a permanent basis.

During the last four years over $3,700,000 has been disbursed for employe benefits, and today there is available $1,800,000 in the fund set aside for this purpose.

Under the plan, the company pays into the fund an amount equal to that paid by all employes. The fund is in the hands of trustees and is kept entirely separate from the financial affairs of the General Electric Co. Under the plan adopted, the maximum weekly benefit is $15 a week for ten weeks, in addition to which employes may obtain loans without security and interest up to $200, and relief grants of $100 in any one year.

All the employes of the company, except salaried employes averaging more than $50 a week, are included in the plan. Every employe pays into the unemployment fund one per cent of his actual weekly or monthly earnings, provided such earnings are 50 per cent or more of his average full-time rate. These payments are continued for 156 weeks. When a person leaves the company's employ for any reason, a refund is made to him or his heirs of the unused part of his payments.

In times of severe unemployment, collections will be increased up to 2 per cent, depending upon the seriousness of the situation. This emergency provision also includes those salaried employes who are earning more than $50 a week, but who are not eligible to benefits under the plan. The fund is administered at the various works by local boards, half of the members being chosen by the employes.

* * *

Good will in the balance sheet may be defined as the value of the disposition of the company's customers to return to the place where they have been well served.

# Formula for Width of Stock Required for Multiple Circular Blanking

By ALBERT A. CAVICCHI

The writer read with interest the article in June MACHINERY, page 677, which contained a formula for finding the width of stock required for multiple circular blanking. Being a diemaker in a small shop having no designer, the writer must necessarily design and plan the dies required. Stamping from two to six circular blanks from strip steel is a very common requirement. For such work, the width of the strip is calculated by common arithmetic, which does not involve the use of trigonometrical functions.

To illustrate the procedure, let us assume that six circular blanks are to be punched across the

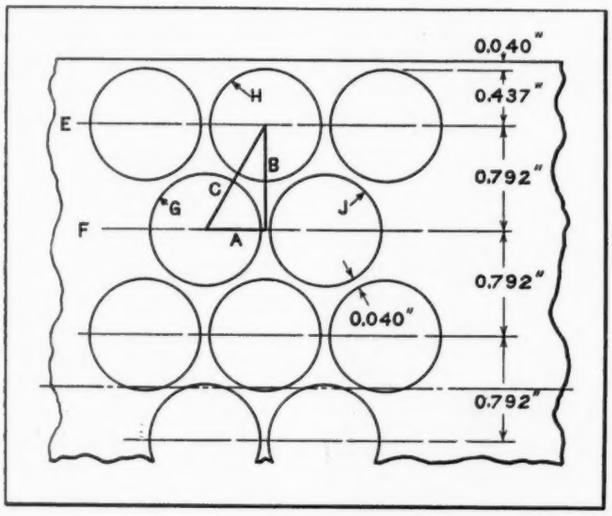



Diagram Illustrating Method of Finding Width of Stock for Multiple Circular Blanking

strip, the diameter of the blank to be 0.875 inch. On a cold-rolled strip steel of No. 2 or No. 3 temper, ranging from 0.012 to 0.025 inch in thickness, the writer leaves a bridge 0.040 inch between the blanks and at the outer edges.

Referring to the diagram, the row of circles on line *E* is drawn first. Line *F* is drawn next, and the circles *G* and *J* are drawn in line with the centers of the bridges in the row of circles on line *E*. Then a line is drawn from the center of circle *G* to the center of circle *H;* and a line is drawn from the center of circle *H* to the center of the bridge between circles *G* and *J*. A third line is drawn from the center of circle *G* to the center of the bridge between circles *G* and *J*. The three lines just drawn form a right-angle triangle, the base being represented by side *A*, the altitude by side *B*, and the hypotenuse by side *C*.

Referring to the diagram, *A* = the radius of the circle + 1/2 the bridge between the two blanks represented by circles *G* and *J*. Thus the value of $A = 0.437 + 0.020 = 0.457$ inch. The side *C* = the diameter of a blank + the entire bridge, or $0.875 + 0.040 = 0.915$ inch. The value of *B* is unknown.

Solving the right-angle triangle by the formula, $B = \sqrt{C^2 - A^2}$, we have $B = 0.792$ inch, which is the distance from the center of one row of circles to the center of the next row across the strip. To find the width of the strip, multiply 0.792 by 5, and add the diameter of one blank and the width of the bridge on each side of the strip. Thus, $0.792 \times 5 + 0.875 + 0.080 = 4.915$ inches, the width of the strip required.

* * *

## Future of Machinery Industry Depends on Attitude of the Administration

According to a statement by Philip E. Bliss, president of the Warner & Swasey Co., Cleveland, Ohio, the course of the machine tool industry during the winter will depend largely upon the Administration's attitude with regard to monetary stability and the regulation of business. Says Mr. Bliss:

"If the Administration will make a frank statement defining and limiting the extent to which deflation of the dollar may be expected, and assuring corporations that they are not to be unduly restricted in their efforts to make a profit, we may expect an immediate rise in machine tool sales, reflecting a similar improvement in general business.

"The need for replacement of old equipment by modern machines is obvious to hundreds of potential buyers. From the standpoint of shop economy, they want to buy, and know they should buy today. But in the face of the present monetary uncertainty, and possibility of further governmental restrictive measures, they are afraid to commit themselves to any purchases save those which are absolutely necessary to keep the wheels turning from day to day.

"It is the extreme uncertainty of the situation, especially with respect to monetary stability, which is at present the most powerful deterrent to increased business. What people want to know is, 'Is there or is there not to be further inflation and devaluation of the dollar? If the dollar is to be further devalued, at what point is it to be stabilized?' Once a firm answer has been made to these questions, business men may make future commitments with some degree of assurance, at least, as to the outcome."

* * *

A safer way to gain assurance against inflation than by keeping millions in the corporation's cash box, might be to convert them into overdue equipment replacements, which . . . could not depreciate as rapidly as money.—*Clarence K. Streit in the New York Times*

# Unusual Planer Operations

By M. M. McCALL

**Special Attachments are Used for Radius and Form Planing, Cylindrical Grinding, and Helical Grooving**

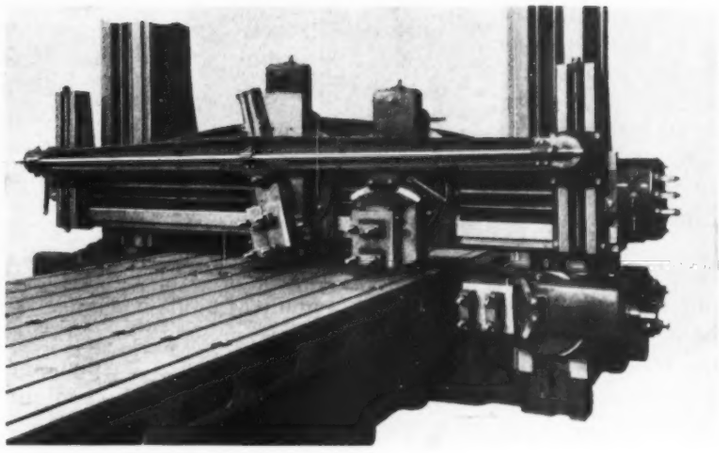


*Fig. 1. Planer with Rail Head at Left Arranged for Radius-planing Operations on Locomotive Frames*

THE requirements of modern industry have made necessary the use of planers for operations other than the usual machining of horizontal, vertical, and angular plane surfaces. Among these requirements are the planing of surfaces with either transverse or longitudinal curves, and the planing of helical grooves when the lead is too large to be cut on a lathe.

Curved surfaces are produced by means of cams in connection with one of the feed movements or the movement of the table. Curves with a radius are also produced by swinging the tool from a center, or rotating the work on centers located on the table. Helical grooves are generated by rotating the work during the cutting operation. The interesting features of some of the machines designed for special work of this kind are here described.

Fig. 1 shows a Niles planer with the left-hand rail head arranged for radius-planing operations on locomotive frames. The head is provided with two tool-slides, the tool-holder being on the outer slide. For regular planing operations, the outer slide is fastened to the inner slide with swing bolts in the U-shaped appendages on the sides of each slide, and by two other bolts, the holes for which can be seen in both slides above the special cross-beam.

When planing to a radius, the outer slide is detached from the inner one and suspended on a bolt centered in a bearing attached to the cross-beam. This bolt is clamped in a dovetail slot in the front face of the outer slide, the distance from the point of suspension to the cutting edge of the tool being equal to the desired planing radius.

As shown in the illustration, the attachment is set to plane the smallest radius possible with this equipment. The circular feed is provided by simultaneously feeding the inner slide vertically and the saddle horizontally across the cross-rail; a block, centered in the inner slide near the bottom, causes the outer slide to swing around its point of suspension on the cross-beam.

In Fig. 4 is shown a locomotive frame mounted on the planer table. The head is arranged to plane its maximum radius on the sur-

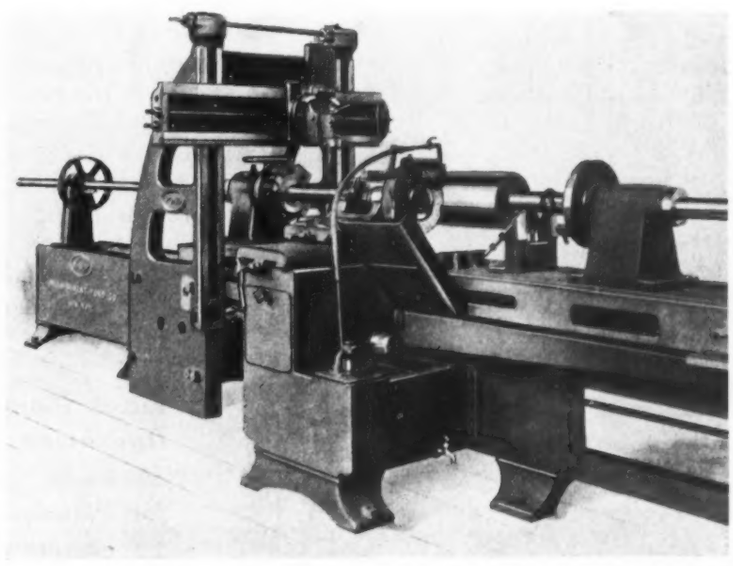
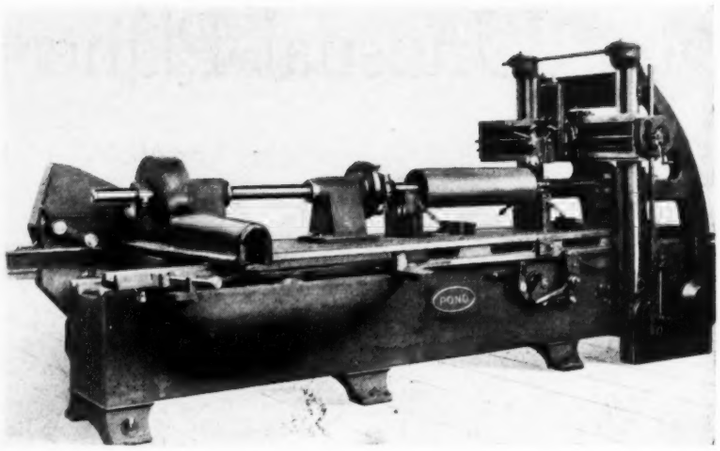


*Fig. 2. Planer Equipped with Roll-grinding Attachment*

*Fig. 3. Planer Equipped with Attachments for Machining Helical Grooves in Rolls*



face that serves as a saddle for the locomotive smokebox. The cutting tool, inner slide, outer slide, and the saddle are shown by dotted lines at the extreme position of the tool to the left of the center line. The tool and the inner and outer slides are also shown at an intermediate position.

A diagram is drawn at the right of the center line to explain the action of the simultaneous feeds. *AB* on the vertical center line is equal to the maximum planing radius and is the distance from the point of suspension of the outer slide to the cutting edge of the tool. *D* is the point where the block is centered in the inner slide. With simultaneous feeds to the inner slide and saddle, the point *D* on the inner slide will travel along the line *DHE*, which is the resultant of *DF* and *FE*, the inner slide feed and the saddle feed, respectively.

The block will cause the outer slide to swing around point *A*, and the cutting edge of the tool will travel along the arc *BC* to *C*, the angle *BAC* being the maximum angle for which the attachment is designed. The point on the outer slide that coincides with *D* will travel along the arc *DIG* to *G*, which is very close to *E*. To swing the outer slide, it is evident that the block will swivel on its center in the inner slide, and that the outer slide will slide along the block, the greatest movement being the distance *HI* when *AH* is perpendicular to *DE*. The block is therefore given a dovetail shape, and the dovetail slot in the bottom surface of the outer slide is made of sufficient length to provide for the movement *HI*.

The center of suspension *A* must coincide with the center of the curved surface on the locomotive frame. If considerable metal is to be removed, the center *A* can be set higher, and lowered after each successive cut until it coincides with the center of the work. This can be done by turning the long horizontal shaft, which will raise or lower the cross-beam by means of bevel gears and rotating nuts on fixed vertical screws in the brackets fastened to each end of the cross-rail. The bearing that holds the centering bolt *A* is transversely adjustable along the cross-beam to suit the location of the work.

### *Grinding Flour Mill Rolls and Cutting Helical Grooves*

Figs. 2 and 3 show a Pond planer equipped with grinding and helical grooving attachments for cocoa and flour mill rolls. The grinding wheel, which can be slid out of the way during planing operations, is rotated by belt from a special countershaft. Suitable table speeds for grinding are also obtained from a special countershaft, and the roll is rotated by a belt on the pulley shown in the rear of Fig. 2.

Fig. 3 shows the machine arranged for helical grooving operations. To generate helical grooves, the work is required to rotate in one direction during the cutting stroke of the table, and in the opposite direction during the return stroke. These movements are obtained

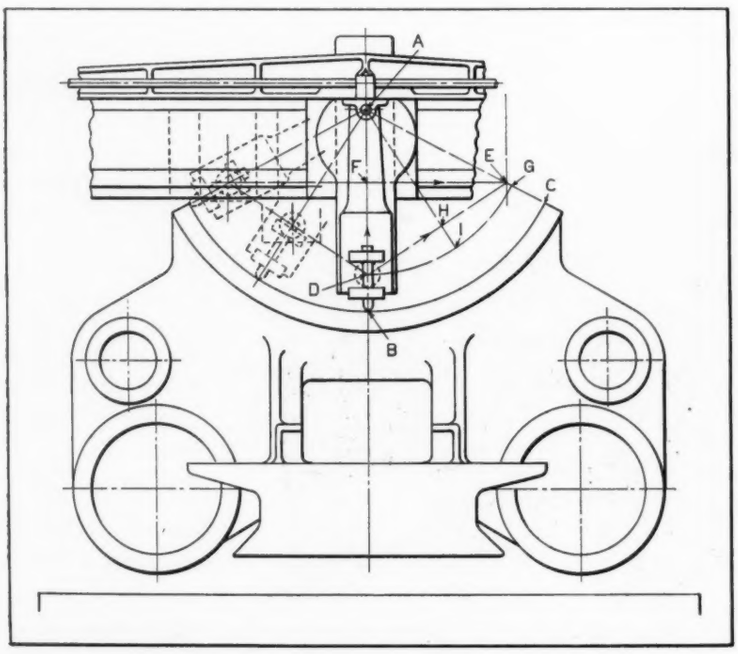
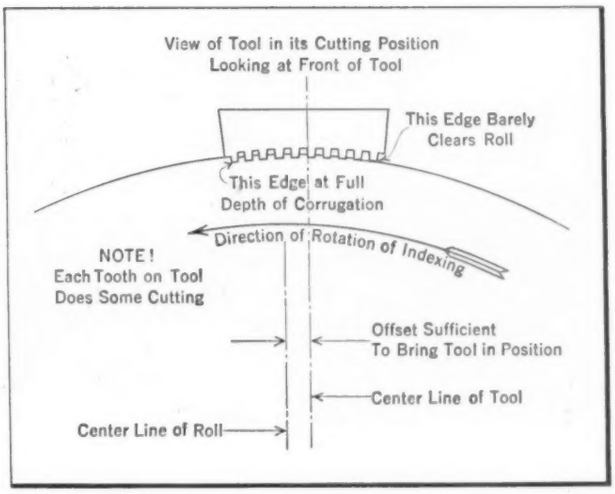



*Fig. 4. Diagram Illustrating Operation of Equipment Shown in Fig. 1 when Used for Planing Saddle for Locomotive Smokebox*

*Fig. 5. Tool for Cutting Helical Grooves Used in Set-up Shown in Fig. 3*




by setting the slotted angle-bar, shown in the foreground, to a certain angle relative to the direction of the table movement.

A block, moving longitudinally with the table and sliding in the slot, will also be moved transversely relative to the direction of the table movement. The block is fastened to one end of a worm-shaft which extends across the table, the worm meshing with a worm-wheel on the shaft that rotates the roll through the driving head. The block does not turn with the worm-shaft, but the transverse movement imparted to it by the slotted angle-bar will cause the worm-shaft to move transversely over the table without turning, and the worm teeth will act similarly to a rack and rotate the worm-wheel and the roll.

In addition to the rolling motion of the roll required to generate the helical grooves, it is also necessary that the roll be given an additional rolling motion in one direction near the end of the return stroke to index the roll. A roller on the lever arm, which can be seen across the table, has just rolled up the inclined surface of a cam at the end of the return stroke. The resultant movement of the lever is transmitted to a gear sector in mesh with a gear centered on the worm-shaft and keyed to a plate holding a ratchet pawl. The ratchet wheel is keyed to the worm-shaft with feather keys. The amount of movement of the pawl is constant, but the construction is such that the pawl can be set to turn the ratchet wheel the required number of teeth to index the grooves accurately. Therefore, the indexing operation is performed by rotating the worm, and the helix is generated by its transverse movement.

In generating the helix, the worm-wheel must make one revolution as the table moves a distance equal to the lead of the helix. The tangent of the angle to which the slotted angle-bar must be set, is therefore equal to the pitch circumference of the worm-wheel divided by the lead of the helix.

The tool can be set in the tool-holder to suit the helix angle. Fig. 5 shows the type of tool used. The tool-slide is fed by hand until the finishing end of the tool has reached the full depth of the groove. The indexing pawl is then engaged, and the remainder of the grooves are finished automatically.

The rolls vary from 8 1/2 to 10 inches in diameter, and the pitch of the grooves from 6 to 40 grooves per inch of circumference. The tools for the various pitches are made to finish a different number of grooves at each stroke of the planer, the roll being indexed accordingly. Only one groove is finished at each stroke when 6 grooves per inch are being cut, but as the size of the grooves is decreased, the number finished at each stroke is increased up to 10 grooves per stroke when 40 grooves per inch are being cut.

In regrooving old rolls, it is not necessary to grind out the old grooves entirely unless the pitch or helix angle is to be changed. A piece of wood is placed in the tool-holder and caused to follow an old groove by rotating the roll as the table is moved. The slotted angle-bar is then set to the angle indicated by the movement of the block on the worm-shaft.

In Fig. 6 is shown a Pond planer with forming attachments on all four heads for planing the curved surfaces on the

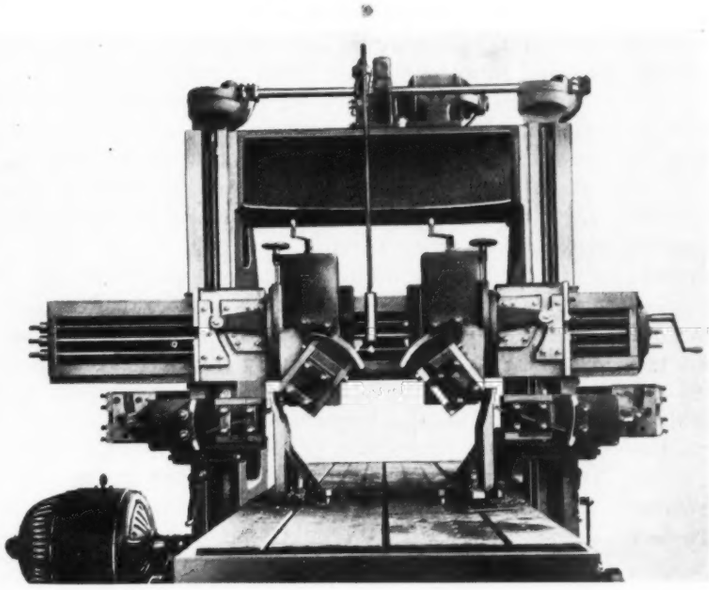


*Fig. 6. Planer with Forming Attachments on All Four Heads for Planing Curved Surfaces on Opposite Sides of Brackets*

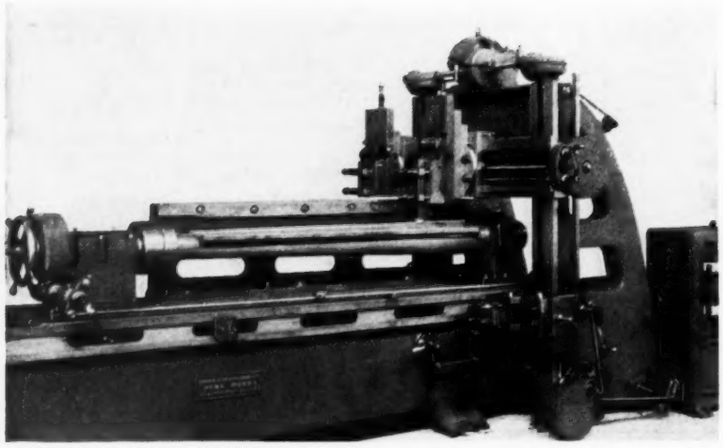


*Fig. 7. Machining a Gun on a Planer Equipped with a Forming Attachment*

brackets clamped in position on the table. The rail heads are disconnected from their cross-feed screws by split nuts, and as the tool-slides are fed vertically, the cams, on plates clamped to the cross-rail, guide the tools in their curved paths. The side-head tool-slides are free to follow the curved path of the cams clamped to the housings as the side-heads are fed vertically. A large number of brackets can be planed when lined up on both sides of the table. Similar attachments are applicable to a large range of work by the use of suitable cams.

A Pond planer equipped with a gun-forming attachment on the right-hand head is shown in Fig. 7. A gun is shown in place on the table. The required outline of the gun is cut in a cam bolted to the planer table. This outline is reproduced by the tool as a roller in the cam slot moves the tool-slide vertically during the cutting and return strokes of the table.

The end of the gun is clamped in a contracting collet, which is rotated slightly between cutting strokes to provide a circular feed for the gun. This motion is obtained through a worm and wheel from a transverse shaft to which a ratchet wheel is keyed. The ratchet pawl is actuated by a shaft along the side of the table, the motion of the shaft being checked by a finger on the housing which contacts with collars clamped to the shaft just previous to the table reversals. It is necessary to plane the outline of the gun, as the two longitudinal projections prevent turning the gun in a lathe.

# Combating Accidents Through Cooperation of Employes

By WILLIAM C. BETZ, Equipment Engineer, The Fafnir Bearing Co., New Britain, Conn.

In passing through almost any plant, one sees numerous practices that involve an element of danger. If employes receive encouragement to spot these dangers and to make suggestions for their elimination, many accidents might be avoided. Perhaps some kind of monetary reward or bonus could be paid for the most valuable suggestions.

In the present article, the writer has recorded a number of suggestions that have been made by employes in plants where he has worked. These examples are recorded simply to indicate how it is possible, through the cooperation of employes, to reduce accidents greatly.

An employe throws in an electric switch and receives a shock. He reports the fact and suggests that a rubber mat be placed under the switch box, to stand on when closing switches.

In tightening the tail-block of a new lathe, a man finds that there is not enough room between the top of the block casting and the under side of the tightening lever to clear his hand. He suggests a change that eliminates the danger of injury to the hand.

Men are working around tanks containing water and other liquids that get on the floor. This makes the floor extremely slippery. A worker suggests that very coarse sand be kept on the floor. When this is done, the danger of slipping is materially lessened.

In connection with tanks and wet floors, another man made a suggestion that if a pipe or round wooden bar were fastened to the inside of the tank at the back, some inches above hot or acid liquids, a man slipping would have something to grab hold of and might be saved from a painful burn.

It has been found next to impossible to induce men using wood saws to employ the guards provided. Someone suggested that men be furnished with gauntlets of closely woven chain-mesh to protect the hands, and that the workers be made to wear them when sawing.

Other suggestions that have been made are the use of shields of unbreakable glass to protect operators from hot chips in turning and planing work; the use of colored glasses by men working in the hardening room; precautions in connection with cyanide pots, the breakage of which may be very dangerous; protection of the hands of men operating milling fixtures when the cutter is revolving; the provision of glass in doors between different departments; and signals that will prevent accidents from electric trucks coming around corners.

# Hob Arbor with Center Supports

**The Design Described, which is Intended for Accurate Gear Hobbing, Has Conical Center Supports and Special Clamping and Driving Features**

By CHARLES H. STANARD

ONE of the difficulties encountered in the rapid production of accurately hobbed gears or spline-shafts is caused by the conventional method of mounting the hob, which allows it to "run out" or assume an eccentric position on the machine spindle. With the spindles and clamping methods usually employed, it is next to impossible to set up the hob so that it will consistently run true within 0.0005 inch on both ends.

First, there is a round arbor projecting from an enlarged section that runs in the bearings of the hob-slide head. In most instances, this arbor is 1 1/4 inches in diameter and has a single straight-sided keyway, 1/4 inch wide and 1/8 inch deep. The clamping is done with a nut having standard threads and acting through the collars and hob against a shoulder approximately 2 inches in diameter at the bearing end of the arbor.

We will consider the accuracy of workmanship necessary to produce an arbor of this kind that will run out less than 0.0005 inch when mounted in the machine. This is a problem of diameter only; if the bore of the hob is more than 0.00025 inch larger than the diameter of the arbor, the 0.0005 inch run-out will be exceeded. Obviously, the bearing fits of the hob arbor must also be maintained.

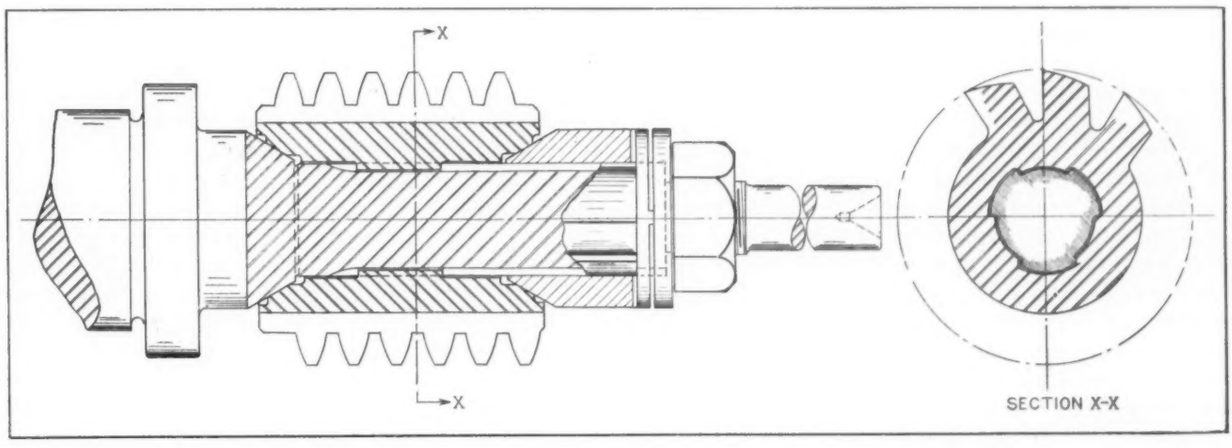
The clamping of the hob presents another set of problems. The face of the shoulder of the hob arbor must run true and be at right angles with the axis of the arbor. The threads and the face of the nut must be at right angles to each other, and the axis of the threads on the arbor must be parallel with the axis of the arbor itself. There are generally from three to five collars on the conventional hob arbor, and they must have parallel faces that are at right angles to the bore, especially if they are a fairly close fit on the arbor.

The hob itself must have a round bore that is accurate within 0.000125 inch on the diameter, if the arbor is to be allowed any tolerance at all. The ends of the hob must be exactly parallel with each other and at right angles to the bore. Now, although the hob and hobbing machines are within these close tolerances, the arbor will be sprung out of true when it is put under strain by drawing up the clamping nut, because the key in one side gives the arbor an unequal cross-section. While a careful operator will tighten the nut just enough to clamp the cutter with the minimum amount of springing effect, there will still be some deflection, and continuous tightening will gradually cause the arbor to assume a curved form.

This is the best condition that can be hoped for, and when the production is large and it is necessary to employ operators who are unfamiliar with the work or who are not careful, particles of dirt may be allowed to get between the collars, or between the collars and the hob or nut, or the clamping nut may be pulled up too tightly, with subsequent bending of the arbor. Hobs are sometimes broken under these conditions.

### *Straightening and Resizing Hob Arbors*

It is the general practice to straighten bent arbors as well as possible and, if necessary, grind,




Arbor with Conical Supports for Hob, Center-driving by Three-spline Shaft, and an Equalizing Clamping Collar

chromium-plate, and regrind them to size. However, it seems impossible to find an arbor repaired in this manner that will run true within 0.001 inch when in operation.

When large batteries of hobbing machines are employed in cutting the same part, it becomes apparent that there are as many different tooth contours as there are machines, and a large part of the variation in the production can be traced directly to hob run-out. There are instances where a hob will operate satisfactorily in only one position; such a hob will be held in this position until dull and will then be resharpened. At least three-quarters of the cutting surface of the hob is wasted under this condition.

### *Center Mounting Used for Work is Applied Successfully to Hobs*

For all of these troublesome run-out conditions, a very simple remedy exists. Early experience in cutting and grinding gears proved that the most expensive way to gain concentricity was by clamping the blanks on an arbor. When it became necessary to hold gears within a "run-out" accuracy of 0.001 inch at the pitch line to obtain the desired quietness in operation, it was found that this could be easily and profitably done by holding the parts on centers, using the same centers for all cutting, turning, and grinding operations.

The center mounting had proved satisfactory on spur gears, but there was some question as to what would happen when cutting helical gears. On trial, it was found just as satisfactory as for spur gears. This method of mounting proved so profitable in the making of good gears that thought was given to its use in eliminating hob run-out by mounting the hob on its own centers during its manufacture as well as during its use in hobbing gears.

The aid of both hob and hobbing machine manufacturers was sought in the development of this plan. A hob and arbor were developed that met the requirements without increasing the difficulty of manufacture.

### *Experimental Tests Determine Design*

The development work included the tests to be described, which show the reason for the design. A regular hob was made up with centers in each end which were machined to an included angle of 60 degrees. Two arbors were then made, one with a keyway and one without. These arbors were about 10 inches long and were mounted between centers for testing the duplication of clamping and its effect on run-out, and also the possibility of splitting the hobs. One hob-mounting center was made integral with the arbor while the other was on a sleeve or collar between the hob and the nut.

A few trials showed that a single keyway could not be employed, because with such arbors the hob would run out amounts that varied with the pressure applied in drawing up the clamping nut. This single-keyway arbor was therefore discarded.

Tests were next carried out on the keyless arbor. Various individual workmen using wrenches with handles of different lengths up to 3 feet assembled the hobs on the keyless arbors. Run-out was produced when the long wrenches were used, showing that a deformation existed in the threads, the effect of which showed up under severe pressure. A great many attempts were made to split the hob without success. An equalizing collar was finally added between the nut and the centering collar, and with this addition, all excess run-outs were terminated. This hob and arbor had an initial run-out of only 0.0006 inch, and maintained this accuracy throughout the tests.

From these tests it was decided that an arbor should have three equally spaced involute spline keys to give a uniform cross-section. One center mounting of this arbor was to be integral with the arbor, while the other was to be a sleeve, having a slip fit on the outside of the arbor. It was also determined that an equalizing collar should be used between the sleeve and the clamping nut, and that center mountings should be finished to an included angle of 90 degrees. Further, the involute spline keys were to have a pressure angle of 30 degrees. The outside diameter of the arbor was to be the same as the existing standards.

The hob finally developed, as shown in the accompanying illustration, has three spline keys of involute form, having a 30-degree pressure angle. The spline keys in the hob are made to clear the arbor by 0.015 inch. Both ends of the hob are counterbored, leaving the driving keys in the middle position of the hob. This makes a stronger hob than the conventional type, because of the elimination of the single key slot. It is expected that only one key will do the driving, the three keys being used to balance the cross-section of the arbor and the hob, thereby minimizing distortion.

### *New Hob and Arbor Show Maximum Run-Out of Only 0.0004 Inch*

A hob-spindle of the design described was secured, and six hobs were made up which were duplicates of conventional hobs in use, except for the center mounting. These hobs were put to work early in the year. They showed a maximum run-out of 0.0004 inch when placed either way on the arbor. The maximum run-out was on the sleeve end in every case tested. The bore of this sleeve was 0.0002 inch larger than the arbor diameter. The only precaution taken in mounting was to have the bearing surfaces of the conical centers of the hob and arbor clean and to have the hob held against the keys while tightening the clamping nut.

The machine on which these hobs were used was run by three shifts with three different operators for several months, and up to the present time, every test has shown that the hobs have maintained

their original concentricity. Inspection of the hobs to determine the nature of the dulling action on their cutting teeth showed a very even wear in each tooth contact, and the work was entirely free from split bearing contours.

The tests already made have demonstrated that all the problems of mounting have been solved. The only feature not proved is that of repairing the arbors in case of accidental bending. So far, it has not been necessary to regrind the center seats or to do any work on the spindle. It has been suggested that, in the case of wear on the seats or accidental bending, the arbor could be straightened and the seats reground with a center grinder while the arbor is mounted in the operating position. This would insure accurate repair of an arbor at a minimum cost.

* * *

## Industry's Opportunity to Promote Recovery

Four fallacies that retard recovery are outlined in a booklet published by the Farrel-Birmingham Co., Inc., Ansonia, Conn. The booklet is written by Allen W. Rucker and N. W. Pickering, president of the Farrel-Birmingham Co., Inc.

"Obviously a maximum volume of trade depends neither on high nor low prices, *per se*," the booklet says, "but upon balanced prices, that is, prices which promote the exchange of equal values. Industry needs to establish this fact, inasmuch as an extension of the use of government credit to promote the exchange of unequal values is precisely the thing that prevents budget balancing.

"This fallacy bids fair to persist until industry establishes the real truth—namely, that the working hours per week can be shortened only as the productivity per worker increases.... If shortening of working hours proceeds faster than increases in productivity, the worker must suffer a diminution in real wages and in his standard of living.

"Manufacturers, under the necessity for reducing costs, must be allowed some flexibility regarding wage rates. To secure freedom to make such adjustments, it ought to be made plain to the wage earners and to the public that such changes will be more than offset by the increase in the number of days worked, and, consequently, in the larger annual dollar income thus made possible.

"In brief, there will be a community of interests when industry and worker concentrate on the best method of increasing the average annual income."

* * *

Recently, on a six-mile stretch on the line between Paris and Brest, in France, a train made a speed record of 119 miles an hour, which is said to be the highest speed ever attained on rails over this distance. The previous speed record is said to be at the rate of 108 miles an hour.

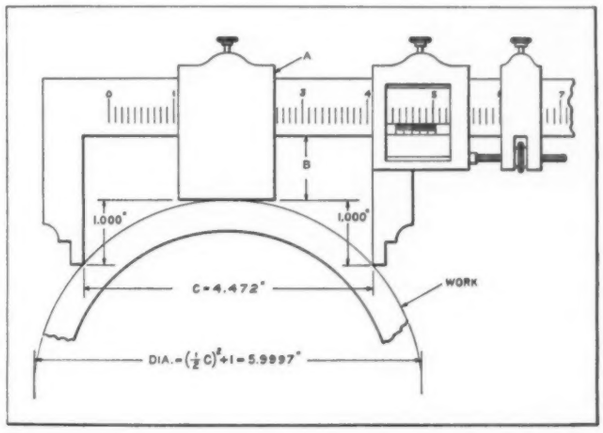
# Finding Diameter of Inaccessible Work with a Vernier Caliper

By PAUL C. BRUHL

With the help of a vernier caliper which permits readings to 0.001 inch and to which has been fitted a sliding block *A*, as shown in the accompanying illustration, the diameter of round work from 2 to 12 inches can be accurately determined where the center is not accessible, but where a large enough part of the circumference can be reached.

The block *A* is made to slide on the bar of the vernier. Its thickness equals the thickness of the jaws, its width may be anywhere from 1/2 inch to 2 inches, and the dimension *B* must be such that the jaws extend 1.000 inch beyond the base of block *A*.

To measure the work, block *A* is moved along the bar of the vernier to a position where it is about




Method of Measuring Segment with Vernier to Determine Diameter

over the center of the work when both jaws touch the circumference. Then the sliding head of the vernier is adjusted until the inside edges of both jaws and the base of the sliding block *A* touch the work. The reading of the vernier to the third decimal place is taken, thus obtaining *C*. The diameter of the work can now be found by the formula:

$$\text{Diameter} = (1/2\ C)^2 + 1$$

The reading, as obtained with the vernier, is 4.472 inches.

$$1/2 \text{ of } 4.472 = 2.236;\ 2.236^2 = 4.9997$$

$4.9997 + 1 = 5.9997 = 6$ inches very nearly, which is the diameter of the work.

* * *

Prosperity cannot be promoted by simply taking from one and giving to another. Prosperity can be promoted only by increasing the total of that which is to be distributed and then seeing that it is distributed fairly.

# Engineering News Flashes

## *The World Over*

### 34,000,000,000 Revolutions and Still Revolving

In 1916, the General Electric Co. placed in service at the Union Stock Yards plant of Armour & Co. in Chicago, a turbine-generator which, since that time, has been on a practically uninterrupted 24-hour-a-day schedule of service. With the exception of two brief intervals for reblading and shutdowns necessary for annual inspections, the equipment has never been shut down. Revolving at 3600 revolutions a minute the turbine-generator has now more than 34,000,000,000 revolutions to its credit; and J. L. Grant, assistant chief engineer of Armour & Co., says, "She is good for a long time yet."

### Unusual Bridge Building Method

To change the course of a river in order to build a bridge across it on dry land, and then make the river return to its accustomed channel under the bridge, is certainly a novel procedure. This method is being followed in an engineering project now under way at Omaha, Neb. At that point, the Missouri River is being diverted so that the bridge piers can be sunk in and erected on the exposed river bottom, thus greatly facilitating the work. The cost of the undertaking is approximately $1,600,000, which is estimated to be far below what it would have been, had the bridge building been carried on in the usual way.

### World's Largest Ship Nearing Completion

The *Normandie*, the giant French liner which will be placed in service in the early summer of 1935, will have a gross tonnage of 79,280 tons. Its total length is 1027 feet, and its width 118 feet. It is expected that its 180,000-horsepower engines will give the ship a speed of 28 knots. The engine-room personnel will number 184. The new British ship *Queen Mary*, to be ready for service in 1936, is of about the same dimensions as the *Normandie*.

### Soviet Machinery Output Gains

According to a statement published in the *Economic Review of the Soviet Union*, the output of the Russian machine-building industry in 1913 was but one-sixth that of Germany and one-third that of England. Now, however, it is stated that the Soviet Republic is second only to the United States in the total production of machine tools, locomotives, freight cars, tractors, and agricultural machinery, surpassing both Germany and England.

### New Marine Engine Saves 40 Per Cent of Fuel

According to an item in *Industrial Britain*, the *S.S. Adderston*, fitted with a White patent combined steam engine, consumed 40 per cent less oil in its trials than the ordinary type of oil-burning engines. The White engine is a combination of a high-speed reciprocating engine and a steam turbine, both being geared to the propeller shaft. The new engine is lighter and occupies less space than the ordinary marine engine of equivalent power.

### Fireless Locomotive Built by Arc Welding

The first locomotive to have a fusion-welded boiler is a fireless steam locomotive built by the Heisler Locomotive Works, Erie, Pa. The tank into which steam under pressure is charged is entirely arc-welded. It is 69 inches in diameter and built for a working pressure of 215 pounds. The shielded-arc process and equipment manufactured by the Lincoln Electric Co. were used in its fabrication. The tank of a 60-ton fireless locomotive, charged with steam of 200 pounds pressure, stores sufficient energy to run the locomotive by itself over a level track, a distance of about 95 miles. It will haul three loaded freight cars weighing 210 tons, a distance of over 20 miles.

### A Novel Flashlight Pointer

To assist in lectures and blackboard demonstrations, a Westinghouse engineer has devised a novel and effective aid consisting of a pointer with a light on the end. By placing this spot of light at the center of interest of the diagram, the speaker is able to focus the attention of his audience on the point of interest emphasizing the area being discussed. Also, when provided with a colored light, it can be used with lantern slides. The pointer is easily made by anyone having need for it. It is

entirely self-contained, consisting of a standard flashlight, a sectional steel fishing rod, fittings, and some small wire. The flashlight proper is the handle of the pointer, with the bulb placed at the end of the fishing pole and connected to the battery through the hollow pole.

## Weighing and Sorting Tin Plate Automatically

At the Grovesend Steel & Tinplate Co.'s works in West Wales, Great Britain, an automatic weighing and sorting machine has been developed. The machine is portable and can be carried about by two men. It places sheets of a specified weight in one pile, putting those under weight in another pile, and those over weight in a third. The device is adjustable for different weights of sheets.

## De-Icers for Airplane Wings

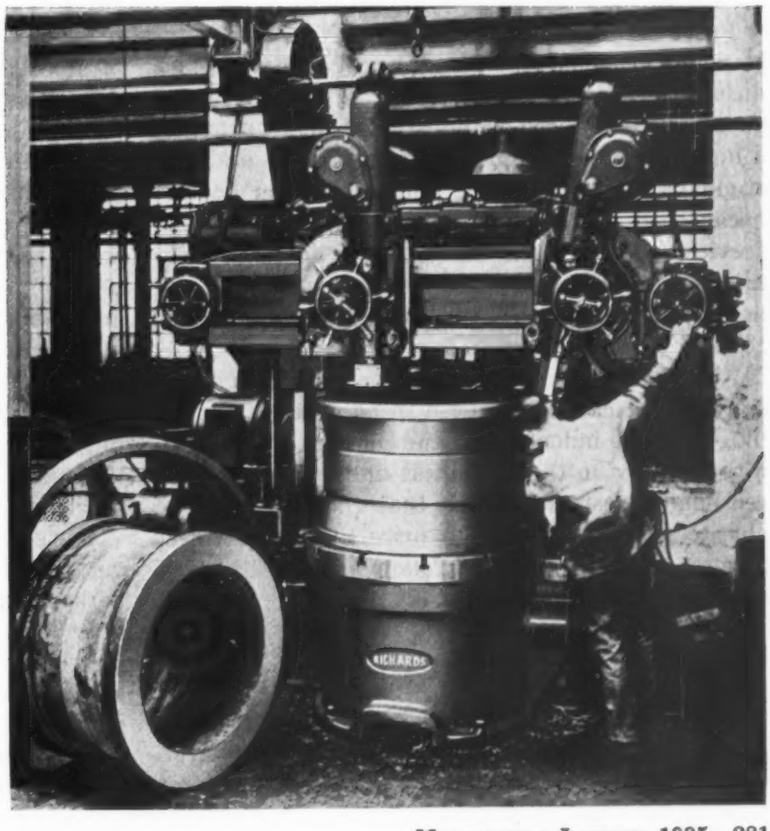
Enough ice can form on the wings and control surfaces of airplanes within a few minutes to send the airplane crashing to the ground or to a watery grave. This was one of the hazards that Colonel Lindbergh had to contend with on his memorable flight from New York to Paris. Nowadays airplanes may be equipped with Goodrich De-Icers—rubber tubes that pulsate and break off the ice as fast as it is formed.

## Soviets Build World's Largest Land Airplane

What is claimed to be the largest land airplane ever built has just been completed in the Soviet Union. The plane, which has been named the *Maxim Gorky*, is a monoplane with a wing spread of 210 feet. It is equipped with eight Soviet-built motors having a total capacity of 7000 horsepower. Numerous successful test flights have already been made. The plane weighs 43 tons and is capable of carrying 40 passengers and a crew of 23. The passenger cabins are located in the fuselage, as well as in the wings, and an automatic telephone system permits communication between different parts of the plane. The maximum speed is 150 miles an hour. The plane carries a fuel capacity for flights of 1250 miles.

## Progress in Civil Works Projects in Italy

The remarkable progress made in public improvements in Italy during the last ten years is well known. As an example of this progress may be mentioned the fact that during this time, aqueducts and water-supply mains aggregating seven thousand miles in length have been constructed. These water works supply water to 2193 communities having a total population of more than ten million people. In addition, the great progress in railroad construction, highway construction, and hydro-electric developments is well known.




***What are Claimed to be the Largest Tapered Roller Bearings Ever Made Have Been Furnished by the British Timken, Ltd., at Aston, Birmingham, England, for a Steel Rolling Mill. The Illustration Shows Machining Operations on the Inner Races of These Bearings***

# EDITORIAL COMMENT

The opinion has been voiced that industry could do more than it has done to provide employment. Many people seem to think that the main purpose of industry is to provide employment, and that whether or not industry can dispose of its products may be lightly dismissed as a mere side issue.

## Industry's Main Purpose is to Produce Goods—Not to Provide Employment

This erroneous idea is due to a fundamental misconception of the purpose of industry, a misconception that prevails not only in popular thought but in high governmental quarters. Some of the recent restrictions on industry are based upon it.

Now, industrial enterprises did not come into being for the purpose of providing employment. The purpose of industry is to *produce goods* and to *render services* that are wanted by the people of the country. In producing these goods and in rendering these services, people are employed; but this employment is incidental to the production or the services rendered, and is neither a purpose nor a duty of industry as such.

Previous to the depression, tens of thousands of young men left the farms and came to the industrial centers because of the higher wages and shorter hours offered by industry. Industry provided a higher standard of living to these men, and this standard attracted them. Industry could do this because, at the time, the demand for goods and services was so great that it could offer opportunities previously not available; but if there is no demand for industry's products, there can be no continued employment in industry.

All this leads to one conclusion: Permanent reemployment can be achieved in no other way than by giving the industries of the country an opportunity to carry on their business unhampered by unreasonable restrictions, so that industry will be able to produce goods at a price that will attract buyers. Employment will follow as a natural consequence.

A machine designer must be able to design parts and mechanisms to meet two requirements—first, efficiency of operation, and second, economy of manufacture. The ability to design for proper functioning involves, in addition to a knowledge of mechanical laws and motions, a thorough knowledge of materials; and economical manufacture depends not only upon the use of the proper manufacturing equipment and processes, but also upon the selection of the most suitable materials.

In considering production methods, the designer must take into account the equipment available in the plant where the machines are to be built. He must thoroughly understand the degree of accuracy necessary. In selecting materials, he must know their physical properties and workability, as these are outstanding factors which may determine whether a part can be die-cast, with little or no machining; whether it should be made from sheet stock in a die; or whether it must be a forging which may require much machining.

## How the Designer Equips Himself for His Job

From this it is evident that the competent designer must have a broad knowledge of modern manufacturing processes and of materials. Where can he obtain such information? It is not available in text-books; and, if it were, it would soon be out of date. Text-books can deal with fundamental principles, but they cannot cover current developments. For information on the day-to-day progress in manufacturing methods and materials, he must turn to other sources.

Manufacturers of equipment and materials have issued many booklets containing valuable information for the designer, and indicating the range and adaptability of machines, processes, and metals. The technical journals also, particularly in those sections that feature new equipment and materials, are invaluable to the designer who believes in keeping one eye on the drawing-board and the other on the machinery and materials to be used in producing the mechanisms that he creates on paper.

The education of the engineer continues throughout life. In early years, the text-books dealing with fundamental principles are invaluable; in later years he is more concerned with current progress, and for this information he must turn to current trade literature. Many designers reach altogether too early a point where their progress seems to be arrested; this is often due to their neglect of available sources of information.

# Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

## Mechanism for Alternately Imparting Long and Short Strokes to Slide

By J. E. FENNO

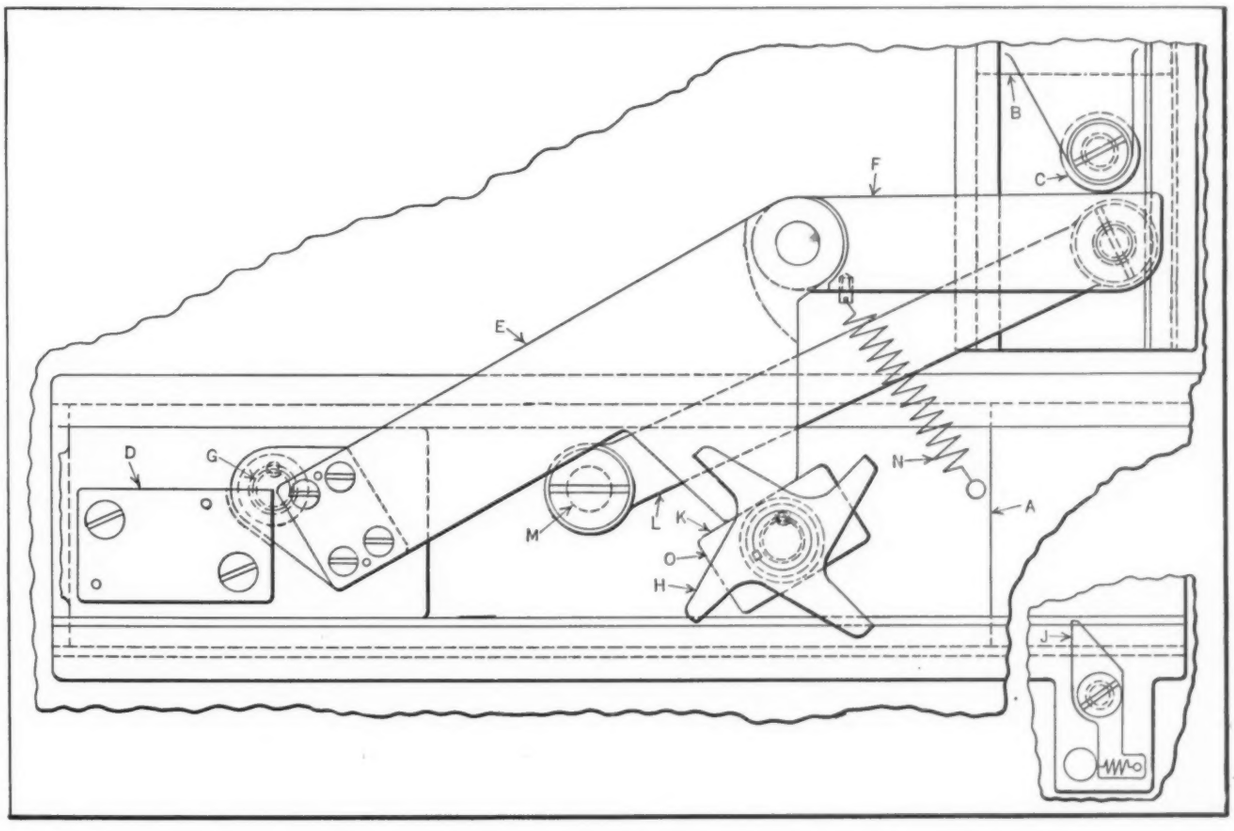
Various types of interesting movements are to be found in automatic carton-stapling machinery. For example, the cam mechanism illustrated imparts a long and a short stroke alternately to a slide, a dwell occurring at both ends of each stroke. This slide serves to change the position of the carton relative to the stapling tools.

Perhaps the most interesting feature of this arrangement is the fact that only one point of reversal is varied to obtain the two different strokes.

The cam is made in three parts, consisting of block *D*, arm *E*, and bar *F*. It is mounted on the slide *A*, which is given a constant reciprocating movement by another member of the machine (not shown). The required movement is imparted to slide *B* by contact of the roll *C* with the cam.

Block *D* is secured to slide *A* and causes slide *B* to dwell at the left-hand end of the stroke. Arm *E* is pivoted at *G* to slide *A*, and its angular position is varied every other stroke by means of the star-wheel *H* and the pawl *J*. Star-wheel *H*, together with the block *K*, is keyed to a shaft that is free to turn in its bearing in slide *A*, while pawl *J* is pivoted to the machine frame. Contact between block *K* and arm *E* is maintained by spring *N*.

Bar *F* maintains a horizontal position on both the long and short stroke of slide *B*, and it was to obtain this condition that the link *L* was incorporated. This link is pivoted to slide *A* at *M* and is connected to the bar *F*. With this arrangement, bar *F* remains in a horizontal position when arm *E* changes its angular position, thus maintaining the dwell at the right-hand end of the cam.




Mechanism by Means of which the Horizontal Reciprocating Slide A Alternately Imparts a Long and a Short Stroke to Slide B

In the position indicated, the cam with slide *A* is at its extreme left-hand position. As the slide moves toward the right, the follower roll *C* rides along bar *F*, causing slide *B* to dwell. Continued movement of slide *A* causes the roll to move on down arm *E* and imparts a downward movement to slide *B*. This movement is continued until the roll comes in contact with block *D*. At this time, slide *B* again dwells until the end of the stroke of slide *A* is reached. While this dwell is taking place, pawl *J* has rotated star-wheel *H* and block *K* approximately one-quarter of a revolution, presenting surface *O* to the projection on arm *E*. This causes arm *E* to assume a steeper angle.

Now, as the slide moves toward the left, the roll dwells along block *D* and moves upward when it engages arm *E*. Owing to the change in the angular position of this bar, however, the roll will be forced up higher than during the preceding stroke of slide *A*. Consequently, a longer movement will be imparted to slide *B*. As the roll leaves the arm, it will ride along bar *F*, and since this bar still maintains its horizontal position, slide *B* will dwell for the remainder of the stroke of slide *A*. Thus for each stroke cycle of slide *A*, the angular position of arm *E* is changed, so that only the upper point of reversal of slide *B* varies.

## Shaft-Reversing Mechanism Giving High Velocity in One Direction

When a shaft-reversing mechanism is required in which the velocity in one direction must or can be greater than in the other, the driver and driven elements may be ordinary gears or gear segments, such as shown in Fig. 1. With this type of mangle gearing, the velocity of the driven shaft is greater in the direction indicated by arrow *a* than in the direction *b*. The velocity is uniform, however, in each direction. The pinion shaft in this case is guided wholly by a groove in the center plate, into which the end of the pinion shaft projects.

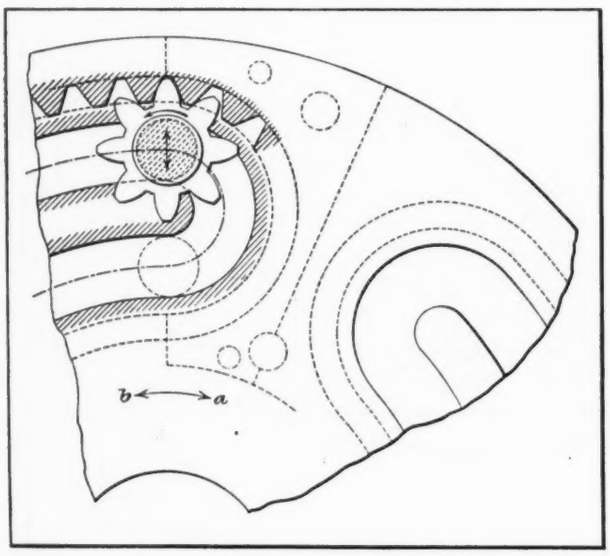



Fig. 1. Shaft-reversing Mechanism that Gives Higher Velocity in One Direction

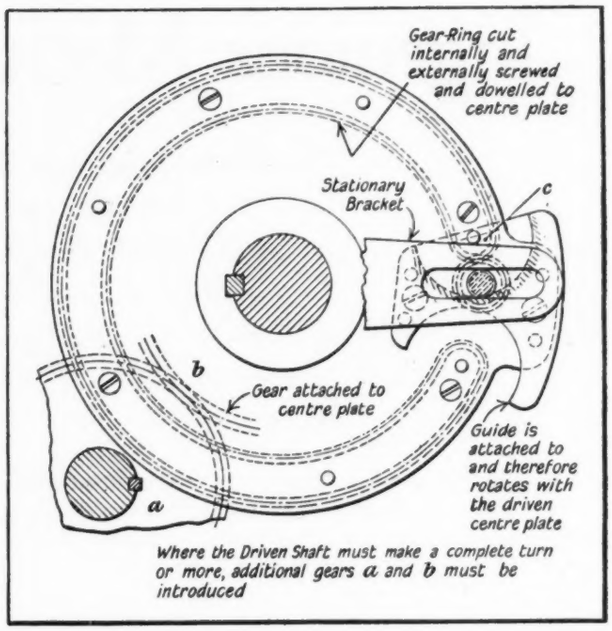

Gear-Ring cut internally and externally screwed and dowelled to centre plate
Stationary Bracket
c
b
Gear attached to centre plate
Guide is attached to and therefore rotates with the driven centre plate
a
Where the Driven Shaft must make a complete turn or more, additional gears a and b must be introduced

Fig. 2. Mangle Gear Shaft-reversing Mechanism with Additional Gears for Obtaining a Complete or More than a Complete Turn

In Fig. 2 is shown a double-edge rack segment-form mangle gear for obtaining reversal of the driven shaft. The round end *c* of the gear ring can be half of a pinion, having a boss or hub by which it is located in a drilled hole in the plate. B. M.

## Inexpensive Intermittent Mechanism

By WILLIAM M. HALLIDAY

Upon inspecting the design of the intermittent mechanism shown on page 147 of November, 1933, MACHINERY, it appears to the writer that the device, as shown, would function inefficiently. Any rotation of the driving shaft would obviously impart a twisting movement to the helical spring, as one end of the spring is in contact with a stationary bracket and the other with the revolving gear. Hence, any substantial movement of the driving shaft and gear might fracture the spring.

A sleeve having a flange or shoulder at its forward end over which the spring would fit could be provided to overcome this difficulty. The sleeve would be made a sliding fit over the shaft and a turning fit in the left-hand bracket or bearing. The sleeve and the driving gear could both be driven by one key set in the driving shaft.

It would also seem preferable to use a hardened cam roller with suitable bearings in place of the

hardened pin. Furthermore, unless a friction brake or some other means were provided to prevent accidental shifting of the driven gear when the gears were out of mesh, there would be danger of the mechanism becoming jammed or locked.

Instead of using a face cam to impart the sliding movement to the driving gear, a cylinder or barrel cam with a helical groove could be attached to the gear hub and a roller for the groove could be mounted on an arm bolted to the right-hand bracket. This would eliminate the necessity for using the helical spring. The teeth of the gears should be chamfered to facilitate meshing. The arm holding the cam roller should be so mounted as to permit a slight endwise movement to prevent jamming and to facilitate meshing of the gears, a spring being used to hold the roller arm in the normal operating position.

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## Power Press Blank-Stacking Mechanism

By F. E. JUDSON

When parts are to be drilled and tapped after blanking, such operations can be facilitated if the blanks are stacked in portable holders. This saves much time in handling, as the blanks can be fed automatically from these holders to the respective operations. A rather unusual type of stacking mechanism that permits this method of handling is shown in the illustration, secured to the end of a die.

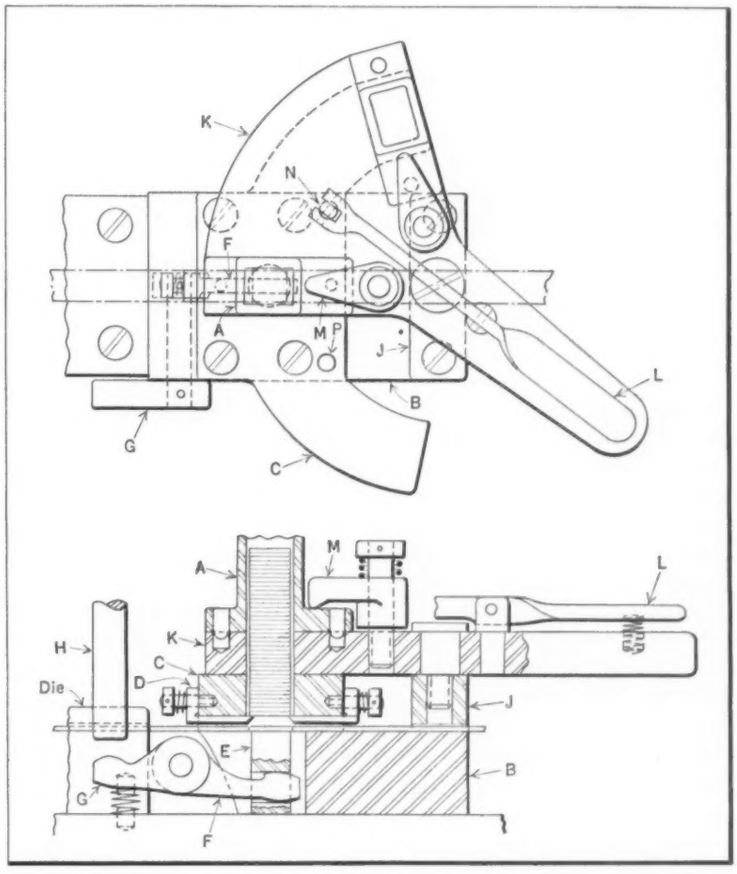
In this die, the blanks are first cut and then pushed back into the scrap. As the scrap travels through the stacking mechanism, a plunger forces each successive blank up into the holder *A*. Two holders are provided, so that while one is being removed from the press the other can be loaded. One of the outstanding advantages of this design is that the blanks are delivered to the holder in a positive manner, and not by gravity as in other stacking mechanisms.

Briefly, the device consists of a base *B*, secured to the bolster plate. On this plate is fastened the winged plate *C* which is equipped with spring fingers *D* for holding the blanks up in the holder after they are raised from the strip by the plunger *E*. The plunger is operated through levers *F* and *G* by the bar *H* secured to the press ram. Pivoted to cross-bar *J* is the swivel *K* on which are mounted the two holders *A*. While being loaded, these holders are clamped in position by the spring-actuated fingers *M*, and held in alignment with the blank holes cut through swivel *K* by dowel-pins. The swivel can be indexed for loading either of the holders by changing the position of the pin *N* through handle *L*.

When the press is started, the strip is fed from left to right by means of a roll feed. After the first blank has assumed a position over plunger *E*, a new blank is cut in the die. In the meantime, as the ram descends, bar *H* operates levers *G* and *F*, causing plunger *E* to rise and force the blank above it past the fingers *D*. As the ram ascends, plunger *E* returns to the position shown, allowing the strip to be fed until the next blank is over the plunger.

Repeated cycles of the press will finally fill the holder. To remove the holder after it is filled, the operator depresses handle *L*, disengaging indexing pin *N*, and then swings the swivel until the empty holder is over the strip. At this point, the swivel is held in accurate alignment by pin *N* as it drops into hole *P*. The full holder is now removed by swinging spring finger *M* to one side.

To prevent spilling of the blanks from the bottom of this holder, a thin knife blade is inserted between members *K* and *A*. In this way, the column is supported while the holder is being removed. The full holder is now replaced by an empty one. The number of holders required depends upon the quantity of blanks to be made. Incidentally, a guard (not shown) is provided between the ram and the holders to provide greater safety for the operator in changing the holders.




Mechanism for Stacking Blanks in Holders as They Leave the Die

# Lubricants for Roller Bearings*

***The Question is Frequently Asked: "What is the Best Lubricant for Roller Bearings?" This Question is Answered in the Present Article. No One Lubricant is Best for All Cases; but when the Operating Conditions are Known, the Best Lubricant for the Purpose can be Readily Selected***

By O. L. MAAG, Lubricating Engineer
The Timken Roller Bearing Co., Canton, Ohio

LUBRICANTS suited for industrial anti-friction bearing applications include the following types: Lime soap, soda soap, aluminum stearate, lead base, and mixed base greases, together with oils of various kinds, ranging from the light bodied non-viscous oils to the heavy cylinder type. These lubricants take care of practically all types of bearings. There are, however, a number of cases where the bearings are heavily loaded or where the speeds are such that a new kind of lubricant, as for example, the extreme pressure type which has come to the fore during the last few years, should be used. These "alloyed lubricants" serve a definite type of service in the lubrication field, just as alloy steels do in modern industry.

Extreme pressure properties may be imparted to either oils or greases, and there are on the market today both extreme pressure greases and extreme pressure oils for lubricating all types of bearings in service.

### *Lubricating Properties of Different Kinds of Greases*

*Lime soap greases*, which are usually the cheapest types of greases to compound, have the widest use. These products, as well as those compounded with aluminum stearate, are used where water may be encountered. They do not, however, have as high melting points as soda soap greases, and their use is usually confined to the lower temperature operating conditions.

When subjected to high operating temperatures, and as a rule with higher operating speeds, a *soda soap grease* is usually preferable. Many greases have the disadvantage of tending to become thin at the higher operating temperatures encountered in high speed equipment. The centrifugal force at the higher speed has a tendency to throw out the oil from such lubricants. After cooling, a layer of heavy soap is found in the bottom of the bearing housings, the oil often having drained out through the bearing closures.

Soda soap greases, as a rule, stand up better under high temperatures and high speed conditions than lime soap products, although it must be kept in mind that there is much in the art of compounding these lubricants to give them the desired properties as regards stability in storage and in service. *Aluminum stearate greases* usually return to their original consistency, even if they are heated considerably above their melting point. This property cannot generally be imparted to lime or soda soap greases.

### *Lubricating Steel Mill Roller Bearings*

In the future, most greases will undoubtedly be of the extreme pressure type. Many steel mill anti-friction bearings will operate successfully with the average greases that do not contain extreme pressure properties. However, there are a number of cases where the extreme pressure greases are necessary, due to the higher speeds and increased loads encountered today. In some of the steel mill applications where past experience indicates that extreme pressure greases are not necessary, they have been used without any harmful effects. Therefore, in order to be on the safe side, the Timken company has made it a practice to recommend extreme pressure greases entirely for this service.

The grease used on roll necks, as a rule, should be water-repellent. Successful results have been reported with lime-lead soap sulphur products, as well as with a lime soap sulphurized base and a lime soap sulphur-chloride base.

Many greases used for roll neck plain bearings are compounded from heavy black oils, soaps, and various percentages of inorganic fillers, such as graphite, lime, talc, mica, zinc oxide, etc. The inorganic fillers polish the bearings, giving in a short time well run-in bearing surfaces. However, the disadvantage of these products is that they continue to wear away the bearings, with the result

*Abstract of a paper read before the National Association of Lubricating Grease Manufacturers at a recent meeting in Chicago.

that replacements are usually quite high. There are numerous instances where better bearing life has been obtained when extreme pressure greases free from fillers were used.

The Timken company has specified that steel mill greases for use with their bearings should carry a minimum load of 33 pounds on the Timken lubricant tester and be of proper consistency for local operating conditions. Three consistencies are usually required. Based on practical experience, the company feels that a lubricant carrying a 33-pound load will give no trouble in this field.

### *Lubricants for Gears and Conveyor Rollers*

Often gears and anti-friction bearings are lubricated with the same lubricant. In this case, the mineral oil which is satisfactory for the gears is usually entirely satisfactory for the anti-friction bearings. In quite a few instances, however, in order to take care of the gears, it has been found necessary for good operation to use an extreme pressure lubricant of approximately 90 to 150 seconds viscosity at 210 degrees F. These lubricants should carry a minimum load of 33 pounds on the Timken lubricant tester. The types of extreme pressure lubricants with which the Timken company has had success for this service are those having a lead soap sulphur base, a chlorinated sulphur base, or a straight chlorinated base.

For conveyor rollers, the type of lubricant is largely dependent on the design of the closures. If the closures are tight, fluid oils are entirely satisfactory. As the frictional loads are lower with oil lubrication, the company prefers to recommend it whenever this type of lubricant can be used. A number of applications, however, are so designed as to make grease lubricants preferable. In such cases, under normal operating conditions, the usual lime soap grease is satisfactory. Where operating temperatures are somewhat high, a change to a soda soap grease which will take care of the additional temperatures encountered is advisable.

### *Lubricants for High-Speed Applications*

For high-speed applications, such as electric motors, high-speed spindles, etc., designed for grease lubrication, the most successful results have been obtained with soda soap products. This type of grease does not separate at high operating speeds and temperatures as do the lime soap greases, and hence better lubrication and much longer bearing life may be expected.

The type of soda soap grease that has given the best service with Timken bearings has been the short-fiber, smooth-texture product. These greases do not have the same tendency to channel that the somewhat stringy fibrous products have, and their lubricating action seems to be similar to that of the lime soap greases. The channeling tendency and poor lubricating quality of the stringy fibrous greases seem to be more pronounced under low-temperature operating conditions. The smooth-textured soda soap greases that have given best results for average service are those compounded with refined oils of from 200 to 600 seconds viscosity at 100 degrees F.

Industrial machinery frequently includes high-speed units in which oil lubrication is desirable. Usually these units carry comparatively light loads. However, high speeds often bring about conditions where overheating is encountered, at least until after the bearings are well run in. In such units, well refined mineral oils are usually satisfactory. A number of cases, however, have been encountered where new installations of bearings apparently were overloaded. In such instances, Timken practice has been to use an extreme pressure oil for a running-in lubricant, merely adding the extreme pressure base oil to the mineral oil. Usually one charge of extreme pressure oil is sufficient to last for the run-in period, after which straight mineral oil is satisfactory.

Sight-feed, constant-level, and wick-feed oilers are ordinarily used on industrial equipment, the latter two types usually being the most economical. In order to have a product that is economical for use with sight-feed oilers, oils compounded with from 1/4 to 1/2 per cent of soaps are used. Such compounded oils adhere better to bearing surfaces and also feed more slowly.

### *Best Lubricants for Heavy Pressures and Low Speeds*

Ball mills and clay mills represent applications where the service is heavy and the speeds low. Usually heavy cylinder oils are satisfactory for lubricating such applications, although at times it has been found advantageous to use extreme pressure products. By using a lighter-bodied oil, but of the extreme pressure type, it is possible to reduce operating temperatures considerably and also show a marked saving in power. At the same time, heavy loads can be carried without harmful effects on the gears or bearings.

### *Advantages of Circulating Oil Systems*

There are a number of applications where circulating oil systems are desired, such as on gear drives. The following advantages may be attributed to circulating oil systems: (1) Ample lubrication is provided. (2) The circulation of the oil through the bearings has a cleansing action, washing out any foreign matter that might be present. (3) There is no churning of the lubricant; hence, with the minimum amount of lubricant present, lower operating temperatures are generally secured. (4) With a circulating system it is possible to provide for settling and filtering the lubricant. In case the lubricant has a tendency to become warm, it is possible to cool it separately, thus keeping the system supplied at all times with clean, cool lubricant. (5) The cooler operating conditions will

reduce the oxidation or breaking down of the lubricant and thus increase its life.

There are, of course, instances where it is not feasible to install a circulating oil system. In such cases, a fixed level oil bath should be maintained and provision made for changing the lubricant at frequent intervals.

### *Lubricants for Railway Bearings*

During the last few years the use of industrial roller bearings on railroad rolling stock has come to the fore, and it seems evident that this application will steadily increase. The Timken company has experimented with greases of various types, and with oils of various viscosities for railway service. To date, however, the best all around results have been obtained by the use of fairly well refined cylinder stock oils of approximately 125 seconds viscosity at 210 degrees F. This type of oil has the advantage of having more body or film strength than the car oils in general use on railroad rolling stock. It also has sufficient body at operating temperatures to avoid difficulty from leakage or loss from the present bearing housings, and partly for this reason operating costs are likely to be lower with this type of oil. The Timken Roller Bearing Co. is inclined to feel, however, that in order to meet extreme weather conditions better, the next move will be toward a lower viscosity oil and one containing extreme pressure properties. By the use of such an oil, there will be lower frictional losses.

### *Testing Apparatus for Greases and Lubricants*

In order to measure in the laboratory the film strengths of various types of lubricants that might be encountered, the Timken Roller Bearing Co. has developed a lubricant and wear testing machine, which has been quite helpful in obtaining data to help solve the problems with which the company has been confronted. Straight mineral oils increase in film strength with increase in viscosity, and this machine demonstrates that fact. In dealing with extreme pressure lubricants, however, the viscosity of the oil is of secondary consideration.

It is realized that considerable work still remains to be done in the development of various types of lubricants to meet the advancing needs of antifriction bearings. The Timken company is constantly conducting tests on products and cooperating with oil and grease manufacturers in an endeavor to solve the needs of the various fields in which roller bearings are used.

# Universal Tooling Provides Production Flexibility

By W. J. RUSSELL, Manager, Merchandising Engineering Department
Westinghouse Electric & Mfg. Co., Mansfield, Ohio

About six years ago, it became evident that the increasing number of styles of parts and finished apparatus in the Westinghouse plant at Mansfield, Ohio, had reached the point where it was necessary to take definite steps to improve the tooling procedure in order to obtain a better flow of material and a lower tooling cost on the standard line of cabinets. A survey of 5800 tools showed that a large number of these tools were being built for parts that became inactive and obsolete when only a very small part of their actual tool life had been expended. The records showed that of these 5800 tools, 3800 had not been used for five years previous to the survey. Of the remaining tools used during that particular year, there were 100 that were used 12 times; eleven that were used 11 times; thirty-three that were used 10 times; fifty that were used 9 times; seventy that were used 8 times; 112 that were used 7 times; 150 that were used 6 times; 220 that were used 5 times; 225 that were used 4 times; 250 that were used 3 times; 275 that were used twice; and 504 that were used once.

The results of the analysis were placed in the hands of the shop departments, the tool-room, and the tool design section, with requests for suggestions as to a tooling program that would result in a satisfactory flow of material through the shop and satisfactory costs for parts and tools. As a result of developments covering a period of four years, a system of universal tooling has been established. The first program using principles of the new method showed tooling costs of but $60,000, as compared with approximately $155,000 for the conventional method formerly employed. About $90,000 would be a conservative estimate of the earnings resulting from this use of the new method.

Following this initial experience, the system was extended to other lines of apparatus with appreciable savings. Within the last few years, not only has the cost of tooling decreased, but the time allowed between sales requests for new apparatus and the production date has been greatly reduced.

* * *

The Atchison, Topeka & Santa Fé Railroad is planning to spend $1,800,000 to air-condition all its principal trains by the time the 1935 tourist season begins. The company already has eighty-nine air-conditioned cars in operation.

# Mechanisms for Controlling Lead-Screw Feeds

**Improved Mechanisms for Starting and Stopping Machine Feeds have been Obtained through More Efficient Means of Engaging Feed-Screw Half-Nuts First of Two Articles**

By M. A. HOLLENGREEN, Assistant Chief Engineer
Landis Machine Co., Inc.

THE type or design of the lead-screw mechanism applied to any particular machine depends upon a number of factors, the most important of these being the magnitude of the load, the tendency of the load to run ahead or drag behind the leading mechanism, the facility with which the parts of the mechanism can be manufactured and assembled, and the ultimate cost.

### *Simple Mechanism for Engaging Lead-Screw*

One of the simplest lead-screw mechanisms is shown in Fig. 1. It is opened and closed by the handle *A* pivoted on stud *B*. The bronze half-nut *C* is attached to the handle at *E* and slides vertically in the groove shown in section *X–X*. The half-nut is shown closed on the lead-screw and locked in position by the latch *F*. This latch is adjustable to compensate for machining errors and wear.

To open or disengage the half-nut, the sub-lever *G* is lifted. This releases the latch and allows the opening spring *L* to force the handle *A* and half-nut *C* upward. When it is desired to disengage the half-nut automatically, an adjustable stop is set to make contact with the trip-rod *H*, so that it will be moved to the right and thus release latch *F*.

When a half-nut only is used in a feed-screw mechanism, it is advisable to support the lead-screw in hardened bushings on both sides of the bronze nut, such as shown at *J*, Fig. 1. When the nut is closed firmly, it tends to push the screw downward. This tendency is resisted by the two hardened bushings that support the lead-screw. With this construction, the lead-screw should always revolve in the direction indicated by the arrow shown in section *Y–Y*. Thus, the thrust resulting from the twisting action of the lead-screw will be taken on the flat guide surfaces of the nut rather than on the retaining stud *K*.

It is necessary to scrape the lead-screw nut to a fit and bearing between the surfaces in contact at *J*. This fit, however, becomes too loose after a period of operation, which results in backlash. Backlash is objectionable and will cause a lead error unless the load is of the same magnitude and always in the same direction. This application, however, is comparatively cheap and can be used when the limits on the lead are not too exacting.

Fig. 2 shows another example of a half-nut feeding mechanism which falls in the same category as that shown in Fig. 1, but is of somewhat different

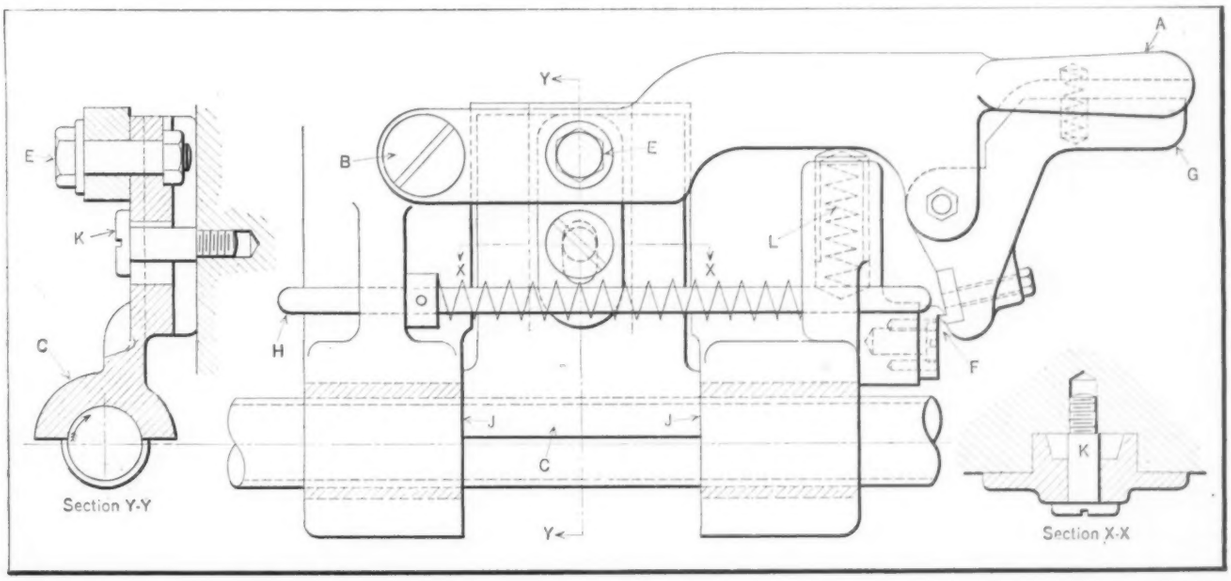



Fig. 1. Mechanism for Engaging Half-nut with Lead-screw Thread

construction. It is opened and closed manually by the handle *A*. When the handle is pushed to the left, the adjustable screw *B* forces the arm *C* downward, causing the nut *N* to engage the lead-screw *L*, which is supported at both ends of the nut. When the nut is closed on the screw, the sub-lever *D* is forced forward by the spring *E*, which allows the latch to lock.

This mechanism can be opened manually, the same as the one shown in Fig. 1, and automatically by means of the adjustable stop *F*. The nut in this design is independent of the opening and locking mechanism. The bronze nut centers itself on the screw and is not machined with reference to any surface, except that the tapped hole must be square with the ends. The lead-screw can turn in either direction. There is no provision for taking up backlash when the nut wears between the thrust surfaces. The springs, in this case, operate directly on the nut, as shown at *X–X*.

### *Design with Two Half-Nuts Actuated by Cam*

The mechanism shown in Fig. 3 is altogether different from the mechanisms shown in Figs. 1 and 2. In this case, two half-nuts are used. Engagement and disengagement are accomplished by means of the steel cam ring *A*. This ring is held in position and guided by the studs *B* and *C*. Studs *B* and *C* are screwed into the carriage casting, while studs *D* and *E* are screwed into the bronze half-nuts. The slots in which *D* and *E* operate are milled as cam slots. The half-nuts are guided in their vertical travel by the slots *F*, milled in the carriage casting as shown in the plan view.

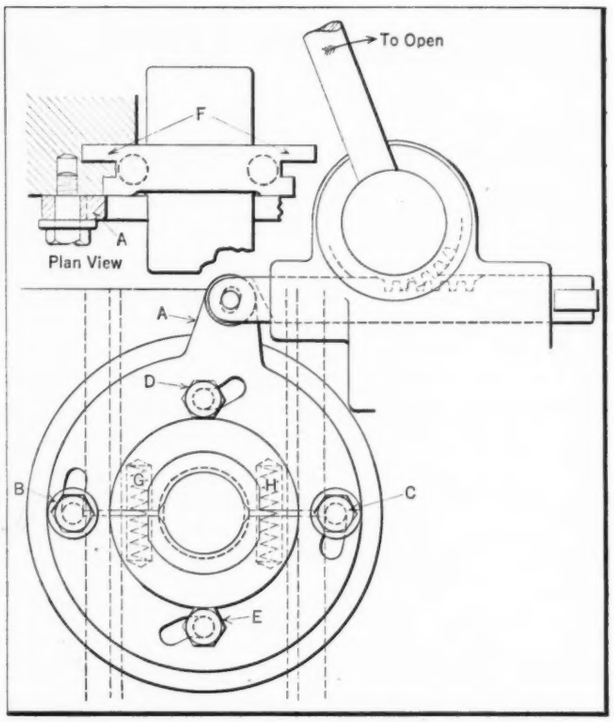



Fig. 3. Lead-screw Mechanism with Two Half-nuts that Can Be Opened and Closed by a Cam Ring

The mechanism is illustrated in the closed position. To open manually, the handle is pushed to the right, which, through the gear and rack, causes the cam ring *A* to move in a counter-clockwise direction. This allows studs *D* and *E* to move apart in a vertical direction and as these studs are screwed into the half-nuts, the latter members are also moved apart, disengaging the lead-screw. The mechanism is held open by the springs indicated at *G* and *H*.

An advantage of this construction is that when the half-nuts are closed, they support the lead-screw on its true axis. The pressure of the half-nuts on the lead-screw is diametrically opposite. Another advantage is the extreme simplicity of the locking mechanism. There are no knife-edge latches to become worn or require adjustment. The force that holds the two half-nuts closed on the lead-screw is self-contained in the cam ring. It is necessary that the vertical slots *F* in which the

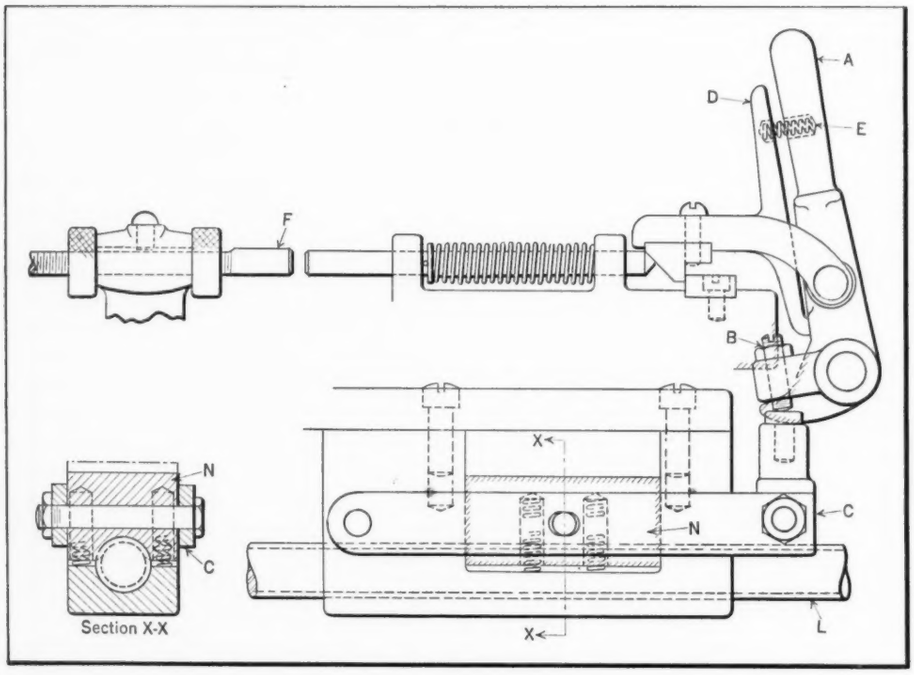



Fig. 2. Mechanism for Controlling Feeding Movements by Engaging and Disengaging Half-nut N and Lead-screw L

half-nuts slide be machined perpendicular to the axis of the lead-screw. No diametrical or backlash take-up is provided.

### *Lead-Screw Nut for Heavy Duty*

When a lead-screw nut mechanism is required to move a very heavy carriage or load, a construction similar to that shown in Fig. 4 is used. In this case, the carriage always drags on the lead-screw, and there is no advantage in having a backlash take-up incorporated in the mechanism. This construction has many advantages with respect to design and manufacture.

The toggle principle is used to open, close, and lock the mechanism. Because of the heavy loads, there is a large frictional resistance between the thrust surfaces at *A* and the carriage casting. This frictional resistance makes it hard to open the mechanism, particularly at the beginning of the movement. It is necessary, therefore, to provide some means that will have sufficient force to start the opening movement and will then diminish.

The toggle construction is used to satisfy this condition. As the lever *B* is moved upward, the toggle has its greatest force, tending to open the nuts. As the lever nears the end of the upward movement, the toggle, of course, is not nearly so effective. There is no tendency for a mechanism of this construction to work open, because when the nuts are closed, the toggle links are over center —almost in a straight-line position.

As the thrust surfaces of the bronze half-nuts become worn at *A*, the whole mechanism moves forward on the pivot shaft *C*, the hardened blocks *E* sliding in their grooves a sufficient amount to permit this movement to take place. Another real advantage is the fact that the thrust load is transmitted directly from the lead-screw through the half-nuts to the carriage casting. This relieves all strain on the mechanism proper, and the jaws *F* merely carry the half-nuts.

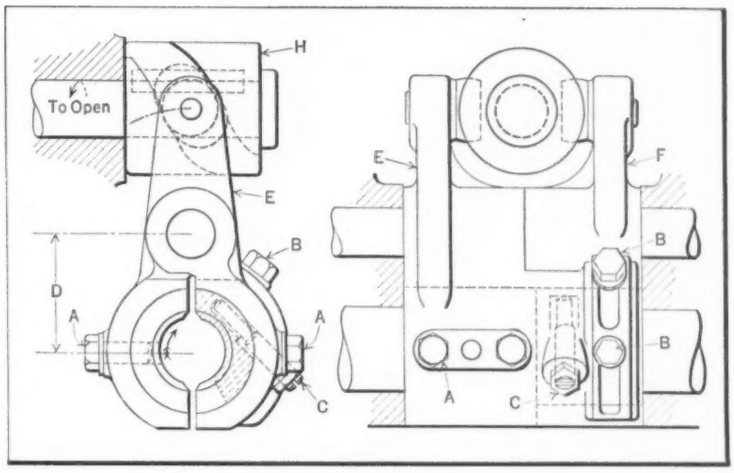



Fig. 5. Heavy-duty Lead-screw with Half-nuts Actuated by Levers E and F, which are Controlled by a Barrel Cam H

This mechanism is very easily assembled. The bronze half-nut clamping screws *G* are not tightened until the mechanism is closed on the lead-screw. This allows the nuts to center themselves properly about the lead-screw, regardless of whether the lead-screw is slightly high, low, or off to one side with regard to the nut mechanism. Should the lead-screw be 0.010 or 0.015 inch low, the half-nuts would simply slide down into position about the lead-screw and would then be clamped. Should the lead-screw be off-side slightly, one of the half-nuts would slide down farther than the other, depending on the direction the lead-screw was off. The lead-screw, in this case, revolves in the direction shown by the arrow. The result would be that the whole mechanism would tend to revolve about the pivot shaft *C*, which would be prevented by the adjustable screw *H*.

The machining operations on the mechanism are simple and of a minimum number. The bronze nut is tapped, faced on both ends, and the seats are milled on the sides. There are no close machining operations on the carriage or jaws. The bronze lead-screw nuts, when worn, are easily and quickly replaced.

Fig. 5 illustrates a lead-screw mechanism used on the same type of machine as that shown in Fig. 4, but in this case a cam and

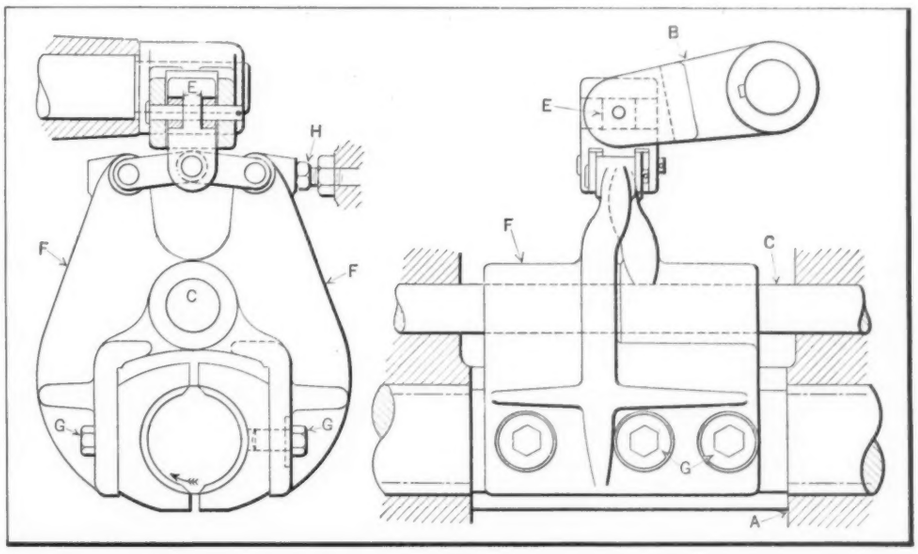



Fig. 4. Toggle Link Arrangement Used to Engage Two Half-nuts with Lead-screw when Feed Must Carry a Heavy Load

roller are used instead of the toggle. It was also necessary to provide a backlash adjustment for this mechanism. The half-nuts are made in three segments. Two of these are much longer than the third. The two longer segments do most of the work and are held diametrically opposite each other by the screws *A*. The third segment is held in position by the clamping screws *B* and the adjustable screw *C*.

If backlash develops in this mechanism, it is only necessary to loosen the clamping screws *B* and turn the adjustable screw *C*, which lies in a recess milled in the adjustable segment. By turning the screw *C*, the adjustable segment is forced around. The adjustment necessary depends on the amount of backlash and the helix angle of the lead-screw thread. The outside of the nuts must be machined concentric with the tapped hole. The center distance *D* must be held to close limits.

* * *

## Better Lighting in Machine Shops

A recently developed compact portable meter for measuring lighting intensities makes it possible to check easily and accurately the intensity of light provided by artificial illumination in industrial plants. It has been fairly well established that a light intensity of 10 foot-candles is a minimum below which one should never go. Tests have revealed that when men or women work under intensities of less than 10 foot-candles, severe eye-strain results in fatigue, nervousness, headaches, and drowsiness. Glare from light sources in the line of vision, reflections from glossy surfaces, and uneven distribution of light are also features that contribute to these objectionable conditions.

Industry has spent enormous sums in developing machines for greater efficiency, but has taken comparatively little note of how the efficiency of the worker might be increased. When the operator finds it difficult to see his work, and when the surroundings are dark and gloomy, efficiency is not at its best. Production suffers, costs increase, and so do accidents.

On the subject of accident, a recent report prepared under the direction of the Illuminating Engineering Society is of considerable interest. This report points out that the National Safety Council estimates that the number of fatalities in the United States arising in the course of gainful employment was 24,000 in 1928, and that in the same year lost-time non-fatal accidents reached a total of 3,125,000. The report also points out that a prominent insurance company states that it is safe to assume that defective vision and deficient or unsatisfactory lighting installations are contributing factors in nearly one-fifth of these accidents. Says this insurance company: "It is a fact that the cost of accidents due to poor illumination greatly exceeds the cost of providing adequate illumination."

## The Buyer of the Worker's Product is His Real Employer

The following letter addressed to the employes of the General Motors Corporation by Alfred P. Sloan, Jr., president of the corporation, stressing the mutual importance of harmonious relations between labor and management deserves wide circulation. It contains much food for thought. The letter reads as follows:

"Recently I sent you a pamphlet outlining the policies governing General Motors' relations with factory employes. In that pamphlet it was said that the relationship between management and employes 'requires a harmonious working together to the end that the quality and cost of the product may be such that the business will prove continuingly successful and will survive.'

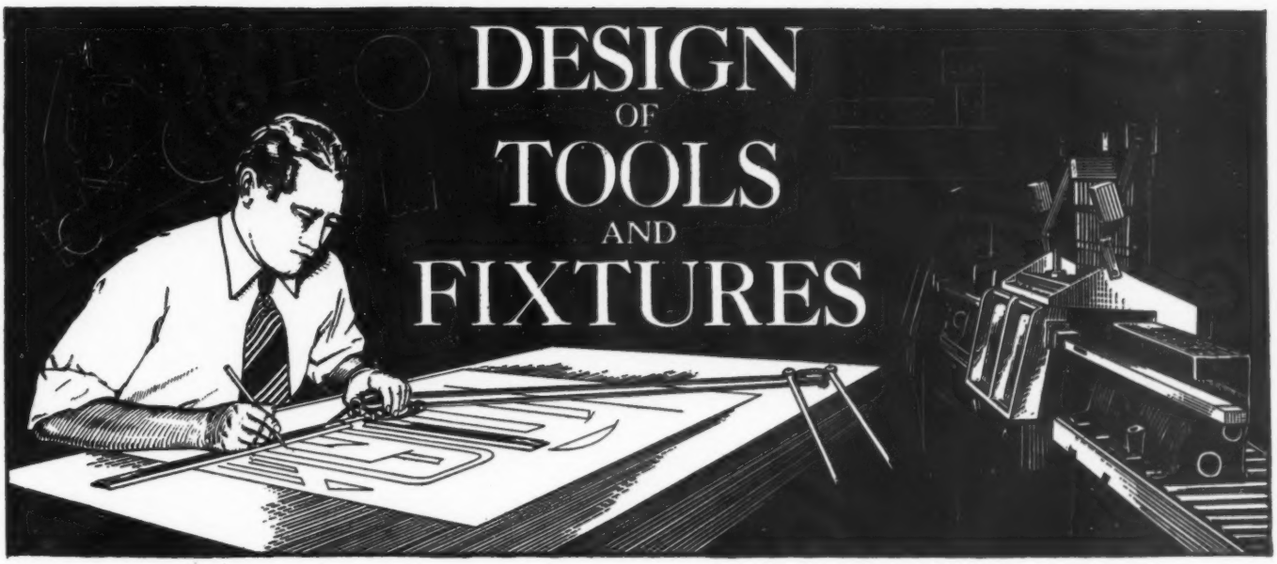
"What this means is that we have to make products which the public will buy, and we can do it only by all working together with that idea in mind. The buyers of our products are our real bosses. They are the ones who provide the money for our wages. We must satisfy them or lose our jobs.

"Your grocer knows that if you and your fellow employes don't like his goods, he will lose your trade, and before long he will have to go out of business. General Motors also would have to go out of business if the public stopped buying our products.

"General Motors has been able to grow and provide more jobs only because we have made products of good quality at satisfactory prices. This has been possible because General Motors' employes and management have worked together. The only way we can keep on satisfying the public is by continuing to work together, with a common purpose—namely, the purpose of maintaining the quality of our products and keeping their prices reasonable. The management cannot do this alone. The employes cannot do it alone. We are all engaged in a sort of cooperative enterprise in which every one of us has his particular place and must do his part. And in doing our part every one of us must remember that we are working together to satisfy the millions of people who buy our products. Intelligent planning, engineering and supervision are necessary. Careful workmanship is necessary. The spirit of fairness and cooperation in our relations with one another is necessary. It is only by real teamwork that we can maintain the quality of our products and satisfy the buyers upon whom all of us depend for our livelihood."

* * *

All the new machinery installed at the Armstrong Siddeley automotive-engine plant in Coventry, England, is painted a soft shade of green instead of the usual gray. Green was chosen because it is restful to the eye, and also shows oil leaks and dirt better than the darker colors.




## Jig for Drilling Angular Holes in Reinforced Flat Plate

By FRANK SERRAL

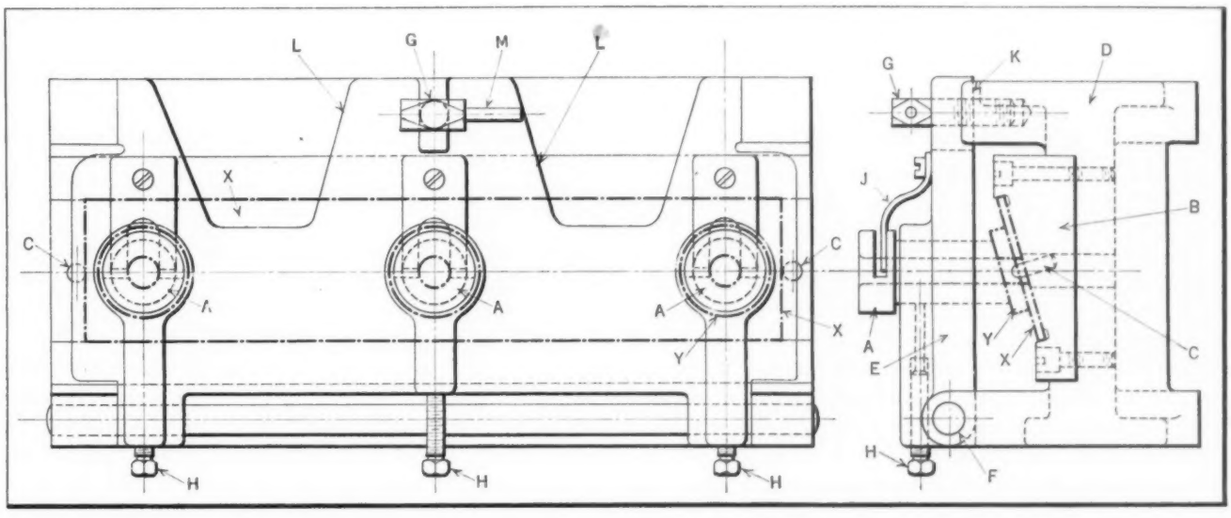
The jig shown in the accompanying illustration was developed for use in drilling three holes through bosses that reinforce a thin steel strip. That portion of the work indicated at *X* consists of a flat piece of comparatively thin stock to which are welded three round bosses *Y*. In drilling the holes through these bosses at an angle to the base portion, it was considered desirable to have a clamp applied to each individual boss to avoid buckling of the work. This was accomplished by employing three drill guide bushings *A*, having beveled ends that engage the work.

These bushings not only hold the work down securely, but they also support the drill clear down to the work, so that the work will not spring away from the beveled surface when starting the drill. The work is supported by a block *B* having a locating nest that holds the work in the correct angular position for drilling. Two pins *C* are provided to locate the work endwise.

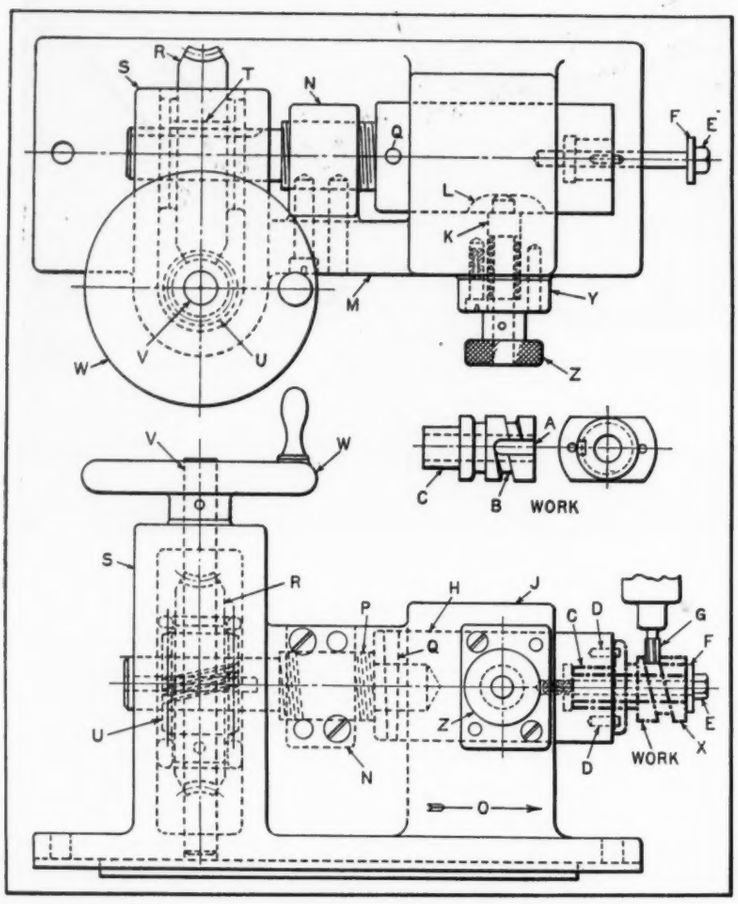
The frame *D* of the jig is of the usual semi-box type construction with a hinged cover *E*, provided with a long hinge-rod *F* on which the cover is swung back for removing the work and for putting it in place. When the cover *E* is down in the position shown, the quarter-turn screw *G* clamps it in place, pin *M* being provided for convenience in turning this screw.

While the cover is being swung into place for clamping the work, the three screws *H* are in their released position, so that the three bushings *A* are not clamped but are free to slide up and down in the holes in the cover. Three flat springs *J* are provided to hold the bushings in place.

The springs *J* exert a downward tension, so that as the cover *E* is swung down into position, the bevel edge of the bushings will come in contact with the




Jig for Drilling Holes at an Angle through Bosses Y Welded to the Thin Plate X




Fixture for Milling Combination Straight and Helical Groove

work and press against the bosses *Y*. The three screws *H* are then tightened, causing the bushings to become in effect a solid unit with the cover. With this clamping arrangement, the three holes can be drilled without distorting the thin steel base plate section of the work. The cover of the jig is cut back at both sides, as indicated at *L*, for the double purpose of reducing the weight of the cover and permitting the user of the jig to observe the work.

## Fixture for Milling Helical Groove and Keyway

By F. SCRIBER

The fixture shown in the accompanying illustration is employed to mill a straight groove or keyway and a helical groove at the same set-up. The keyway or straight portion milled in the work is indicated at *A*, and the helical groove at *B*. The straight groove permits the part to be pushed lengthwise past a pin, after which it is locked by turning it so that the pin engages the helical groove.

The work *X* is centered in the spindle of the milling fixture by the hub *C*, as shown in the lower view. Two pins *D* locate the work, while a lock-screw *E* is used in combination with a slip washer *F* to clamp the work in position. The end milling cutter *G* is held in the vertical spindle of the milling machine. The head of screw *E* is made small enough to permit the work to pass over it when the slip washer *F* is removed.

The work-supporting spindle *H* is free to revolve in the boss *J* of the fixture, except when the spring pin *K* is allowed to enter the slot *L* for milling the groove *A*. When groove *A* is being milled, the entire fixture and table of the milling machine are fed longitudinally in the usual manner until they come against a stop, after which the helical milling of the groove is accomplished.

Attached to the frame *M* of the fixture is a threaded nut *N*, having a helix angle equal to the helix angle of the groove *B*. A threaded short shaft *P* in nut *N* is secured to spindle *H* by pin *Q*. Shaft *P* is a sliding fit in the worm-wheel *R*, which is retained between the sides of housing *S* of the fixture. A key *T*, fixed in the worm-wheel, is a sliding fit in the relatively long keyway in shaft *P*. The worm at *U* is mounted on a small shaft *V*, which has a handwheel *W* that provides means for revolving the worm-wheel and also the work.

The spring pin *K* is held in place by means of plate *Y*, while a hand-knob *Z* is provided for withdrawing the pin from slot *L* when it is necessary to revolve the work. Thus the fixed spindle *H* can be revolved or fed longitudinally as desired. In use, the work is first put in place, as indicated at *X*, with spring pin *K* in slot *L*. The entire fixture is then fed to the right, as indicated by arrow *O*, until the table comes against a properly located stop. Knob *Z* is now pulled outward to disengage pin *K* from slot *L*, following which handwheel *W* is immediately turned, causing spindle *H* and the work to revolve through the drive consisting of shaft *V*, worm *U*, and worm-wheel *R*. Screw *P* and nut *N* cause the spindle to travel in a helical path, which results in milling the helical groove in the work.

At the end of a complete revolution of the spindle, the spring pin *K* again snaps into slot *L*, and it is necessary to withdraw it and revolve the spindle back to its original starting point to receive a new part. Operation of this type of fixture requires the exercise of a reasonable amount of attention. While the necessary functions of milling are accurately controlled, failure to watch closely the depth of the longitudinal cut before milling the helix, or failure to return the spindle by rotating it in the reverse direction after machining each unit, will

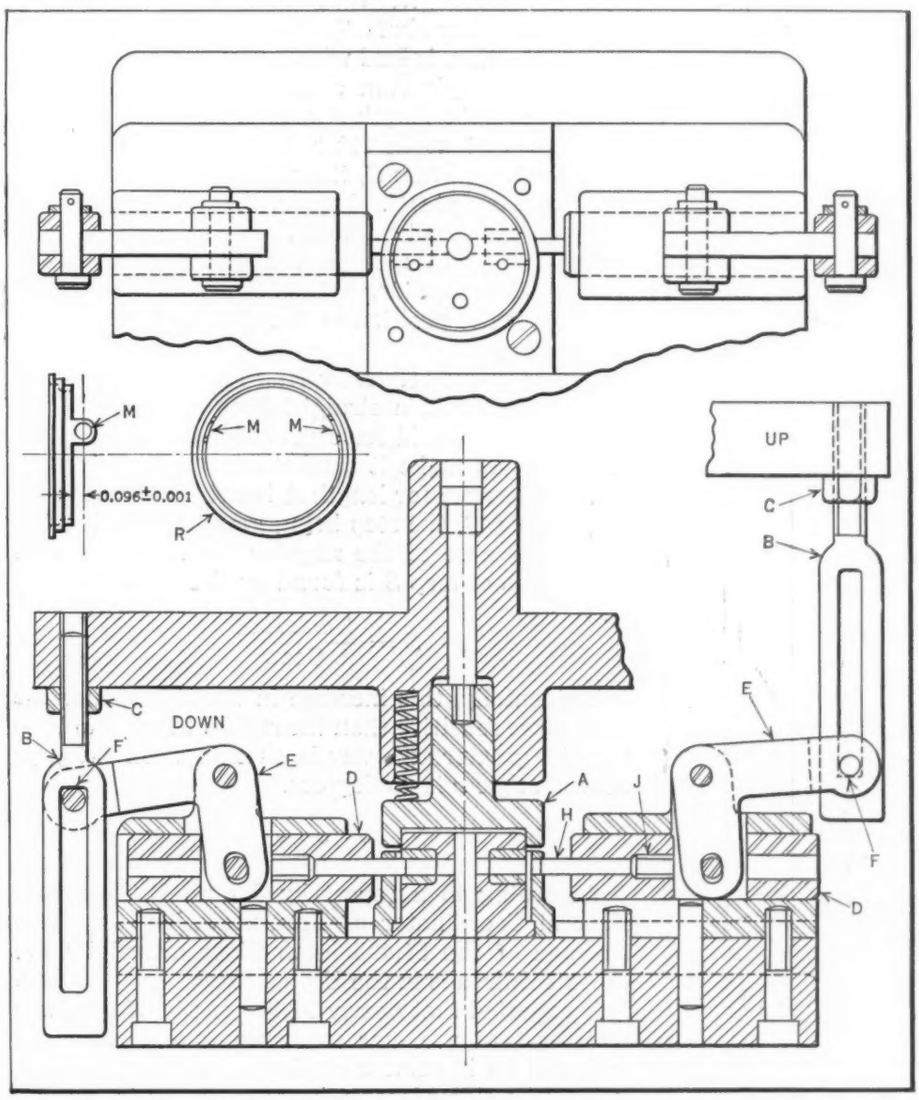
result in spoiled work. However, the operator who becomes accustomed to work of this kind seldom commits an error in manipulating the machine controls.

## Piercing Die Having Horizontally Opposed Punches

By HARRY S. TAYLOR, East Cleveland, Ohio

The accompanying illustration shows a die that is being used successfully for piercing the side holes *M* in the stepped flange or ring *R*. The positioning as well as the size of the holes must be held to close limits of accuracy. In order to make clear the operation of the die, it is shown with the left-hand side down and the right-hand side up. On the down stroke the spring plunger *A* holds the work firmly in place while the holes are pierced.

The links *B* are adjustable and can be locked in place by nuts *C*. Punch-holders *D* are close sliding fits, and are operated on the down stroke by the links *B* through bellcranks *E* when the upper ends of the slots in links *B* come in contact with the pins *F* in the bellcranks. The punches are withdrawn on the up stroke when the lower ends of the slots come in contact with pins *F*. The punches *H* are locked in place by set-screws *J*.




Die for Piercing Two Holes M Simultaneously in Stepped Ring R

## Tool for Boring Two Steps of Different Sizes in Blind Holes

By PETER F. ROSSMANN, Detroit, Mich.

The boring of two steps in the blind hole in the work *W* shown in the illustration (see next page) presents an unusual machining problem. The diameter *Y* of one step is larger by approximately 0.005 inch than the diameter *X* of the other step. The nature of this work is such that it is impracticable to hold it in a chuck for the boring operation. The machining problem was solved satisfactorily by the use of the boring-bar shown in the illustration.

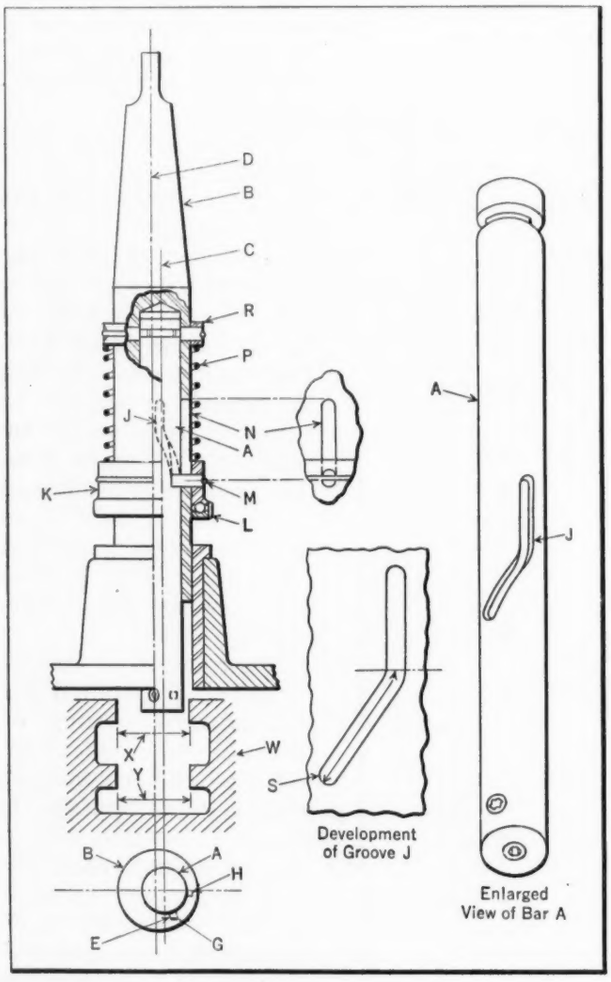
Referring to the illustration, spindle *A* is located eccentrically in the main driving bar *B* on center line *C*, line *D* being the center line of bar *B* and of the steps to be bored in the blind hole. The outward feeding movement imparted to cutter *E* is obtained by rotating the spindle *A* on its eccentrically positioned center line or axis *C*, so that the cutter is carried from point *G* to *H* (see end view in lower left-hand corner).

The rotation of spindle *A* in bar *B* required for the outward feeding of cutter *E* is produced by the spiral portion of groove *J* in spindle *A*. Sleeve *K* is fitted with a thrust bearing *L* and a pin *M* which passes through the slot *N* in bar *B*. Pin *M* extends into the groove *J* of spindle *A*, in which it is a close fit. Spring *P*, acting between collar *R* and

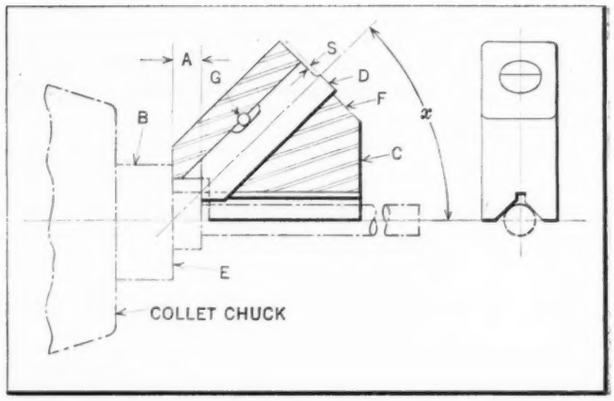
sleeve $K$, positions cutter $E$ at $G$ through the action of pin $M$ against the lower end $S$ of groove $J$. The axial length of slot $N$ is made slightly greater than that of slot $J$ to insure free contact of the point $S$ in slot $J$ with the pin $M$.

The operation of the boring-bar is as follows: On the initial downward movement of the boring-bar, the upper step is bored to the diameter $X$. This step is completed when the bearing $L$ comes in contact with the fixture bushing, at which point cutter $E$ begins to rotate from position $G$ to $H$ through the action of pin $M$ in groove $J$, while the spring $P$ is being compressed. As cutter $E$ approaches the lower step, pin $M$ reaches the straight portion of groove $J$ and cutter $E$ is positioned at $H$. Continued downward movement from this point results in boring the lower step to diameter $Y$. Pin $M$, moving up in the straight portion of groove $J$, maintains cutter $E$ in position $H$.

The upward movement of the boring-bar produces a reversal of the boring and feeding movements. The hand of the spiral groove $J$ prevents the cutter from creeping from position $G$ to $H$ while boring the upper step to the diameter $X$, the thrust of point $S$ against pin $M$ being downward.




Tool Used in Drill Press for Boring Steps of Different Sizes in Blind Hole




Angular Flush-pin Gage Used in Checking Length A of Shoulder on Shaft

## Gage for Checking Length of Shoulder on Shaft

By J. E. FENNO, Belleville, N. J.

The shoulder length $A$ on the hardened and ground impeller shaft $B$, shown in the accompanying illustration, is held within very close limits. The angular flush-pin gage shown is used to check the accuracy of the length $A$ after grinding the shoulders, as well as in later inspection. It consists merely of the block $C$, the sliding flush-pin $D$, and the retaining pin $G$. In use, the vee of the block rests on the small part of the shaft with its left-hand end against the second shoulder $E$. The length of the shoulder is then checked for accuracy by feeling the position of the step $S$ in relation to the surface $F$.

Owing to the relatively long length of the small end of the shaft, a straight flush-pin gage of the regular type would have proved unsuitable, as its length would make it cumbersome to handle.

The tolerance for length $A$ is not the same as the step on pin $D$, the step being greater than the tolerance, because of the angular position of pin $D$. The length of step $S$ is found by the formula

$$S = \frac{\text{Tolerance}}{\text{Cos } x}$$

Incidentally, this increase in the step makes the gage more sensitive than the straight type and thus permits greater accuracy in checking. In the gage shown, angle $x$ is 45 degrees.

* * *

According to a report by Joseph B. Eastman, Federal Coordinator of Transportation, the average age of the 51,425 locomotives owned by the Class 1 railroads in the United States is 20.7 years. It is expected that nearly 21,000 of the 27,600 locomotives that are now over twenty-one years old will still be in service at the end of the next five years. The oldest locomotive found to be in serviceable condition was built in 1865.

# The Olympia Machine Tool Exhibit

WHAT is believed to be the largest machine tool exhibition ever held was staged at Olympia, London, England, from November 8 to 24. This was the fifth machine tool and engineering exhibition held under the auspices of the British Machine Tool Trades Association. The exhibition included not only British developments in the design and application of machine tools, but also important machine tool developments originating in the United States and on the continent of Europe.

It is stated that at this exposition there were not less than 11,000 individual machines exhibited, aggregating in weight about 10,000 tons and ranging from 30 tons apiece downward; but of this number, we understand, only approximately 1000 were actually what is defined as strictly machine tools. W. B. Lang, president of the Machine Tool Trades Association, is quoted as having estimated the value of the machines exhibited to be about $5,000,000.

The Machine Tool Trades Association has staged many fine exhibitions in the past, but never one on so great a scale, nor one that created the atmosphere of a vast machine shop to the same degree as this one. The visitor found himself in a shop atmosphere rather than in that of an exhibition hall. The exposition was unique in the fact that it presented a thoroughly international effect, and for that reason was more representative of the machine tool developments of the world than any similar fair previously held.

Among the tendencies in machine tool developments most prominently in evidence were hydraulic controls for speeds and feeds, automatic lubrication, electric control of feeds and speeds, the use of photo-electric cells in machine tool control, convenient application of cam feeds, and developments in multiple hobbing and in high-speed and precision boring. The tremendous influence on machine tool design created by the use of tungsten-carbide cutting materials was much in evidence.

The exhibition was a true representation of the high standard of efficiency to which machine tools have been developed and the ever increasing rate at which metal parts can be manufactured in quantity with a high degree of accuracy. Pre-eminently, it was an exhibition for the production engineer, showing how time and materials can be saved by the use of up-to-date machinery of high capacity requiring small floor space.

Electrical equipment, which has of late years been of the greatest importance in the design of machine tools, was a feature of the exhibition, as demonstrated by individual exhibits and by machines in operation. There was ample evidence that the machine tool manufacturer and the electrical equipment designer have cooperated to mutual advantage. The same may be said on the subject of lubrication. Here, again, there was evidence of thoroughgoing cooperation.

The extensive developments in portable pneumatic and electric tools were much in evidence, and considerable interest was attached to the exhibits showing recent progress in heat-treatment and the industrial application of pyrometry. The abrasive exhibits also deserve mention.

Another section of the exhibit of no less importance than machine tools was that devoted to shop transportation. Many of the recent improvements in power shop trucks were given prominence, and the importance that efficient methods of materials-handling play in shop operation was duly emphasized.

The British Machine Tool Trades Association, and especially those of its officers responsible for this exhibition, are to be congratulated upon the success of this most outstanding machinery exhibit.

* * *

## New Departure Stages Progress Show

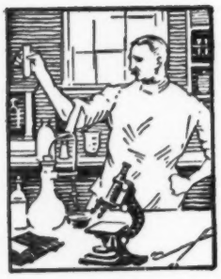
The sales engineers of the New Departure Mfg. Co., Bristol, Conn., witnessed a unique progress show at the annual sales conference in Bristol early in the month. Instead of taking the salesmen through the entire plant in order to demonstrate the progress of research and improvements in manufacturing processes, the factory was brought to the salesmen in the form of a Hall of Progress which occupied one entire floor of the Administrative Building. In this show, many of the new machines developed during the last twelve months were shown in operation to illustrate the newly adopted manufacturing methods. New devices were also exhibited for controlling the metallurgical characteristics and inspecting the dimensions of bearings.

* * *

## Navy Department Wants Engineering Draftsmen

The United States Civil Service Commission has announced open competitive examinations for a chief engineering draftsman, a principal engineering draftsman, a senior engineering draftsman, and engineering draftsmen, for work on ships. Applications should be filed with the United States Civil Service Commission, Washington, D. C., not later than January 14. The entrance salaries for the different positions vary from $1800 to $2600 a year.

# MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

## Sheets of Zinc and Steel Fused Together

Steel sheets with a zinc coating permanently fused to the sheets, so that there is no definite dividing line between the zinc and the steel are manufactured by the Inland Steel Co., Chicago, Ill. Because of the method of manufacture, these sheets can be stamped, drawn, spun, or otherwise fabricated without the zinc coating flaking off. Parts made from these zinc-alloy steel sheets need not be galvanized after fabrication in order to protect them from rust. It is claimed that the zinc coating cannot be dislodged from the steel base even by rough usage.

The zinc coating is unusually smooth, but it is not glazed and it is not arranged in spangles, as when sheets are galvanized. Thus the zinc coating provides a suitable base for art lacquers, enamels, paints, and other finishes.

These zinc-alloy steel sheets also withstand heat up to the softening temperature of zinc, and do not flake off even under conditions where the temperatures change rapidly from high to low. Hence, the material is suitable for use in the making of gas ranges and refrigerators. The unusually long life of the material also makes it particularly advantageous for use outdoors.

## "Ceralumin"—an Aluminum Alloy Containing Cerium

In a light aluminum alloy recently placed on the market by J. Stone & Co., Ltd., Deptford, London, S.E. 14, England, a small amount of cerium is used to obtain an alloy of low specific gravity and comparatively high tensile strength. In addition to imparting these properties to the alloy, cerium improves the casting qualities, enabling castings to be produced in the foundry with clean and smooth surfaces.

The analysis of the alloy is covered by a patent. It is as follows: Copper, 2.5 per cent; nickel, 1.5 per cent; magnesium, 0.8 per cent; iron, 1.2 per cent; silicon, 1.2 per cent; cerium, 0.15 per cent; and the remainder aluminum. Castings of this alloy are heat-treated at a temperature between 960 and 995 degrees F. for four to six hours, and are quenched in water. They are then aged by holding the temperature to 350 degrees F. for sixteen hours, and again quenched in water.

Chilled castings, fully heat-treated, have shown a maximum tensile strength of from 46,000 to 54,000 pounds per square inch, and sand castings, also fully heat-treated, from 38,000 to 40,000 pounds per square inch. The hardness is from 130 to 140 Brinell. A high fatigue value is another advantage claimed for Ceralumin.

## Gold Welded in Thin Sheets to Stainless Steel

Laminated metal strips consisting of stainless steel with a veneer of gold welded to each face are a recent development of the General Plate Co., Attleboro, Mass. This material is being used in the manufacture of parts used in dental work and for some classes of jewelry. Stainless steel is used as the base material because it resists body acids and, at the same time, is cheaper than solid gold.

Each gold layer is usually equal in weight to one-twentieth the total weight of the laminated strip. The gold layers can be welded so securely to the base metal that there is no likelihood of their separating during forming operations.

## Wood Wheels Selected by Navy to Withstand Sea Water

Seaplanes used in the Canal Zone by the Aircraft Division of the United States Navy are hauled in and out of the water by means of a tractor and four-wheeled dollies of special construction. These dollies must withstand both the action of sea water and the heat of a torrid clime. They must be rust-proof, water-proof, and salt-proof. In selecting wheels for these dollies, the Navy Department chose the end-wood type made by the Metzgar Co., Inc.,

Grand Rapids, Mich. End-wood wheels are made by this concern in light-duty, regular-duty, heavy-duty, and super-strength styles. The light-duty style was described in April, 1934, MACHINERY.

## Terne Plate is Easily Fabricated into Many Parts

Terne plate has long been used as a roofing material, and its properties for this service are widely known. The average reader, however, will be surprised to learn that about 40 per cent of all the terne plate produced in this country is used for the fabrication of an almost endless variety of articles. A long list prepared by a leading maker of terne plate includes such common items as automobile radiators, gasoline tanks, and hot water heaters; clock cases and parts; toys; burial caskets; farm implements; furniture; mail boxes; paint cans; radio parts; weather stripping; window frames; and washing machine parts.

"Just what is terne plate?" is a question that might be difficult for many persons to answer. It is a steel sheet coated on both sides with an alloy of tin and lead. The name was probably derived from the word "ternary" which is an adjective that means to be formed of, or to consist of, three. The composition of the coating varies from 12 per cent tin and 88 per cent lead up to 50 per cent of each. Tin is used because lead does not alloy with iron. The tin apparently alloys with the base metal and then forms a binder for the lead-tin coating.

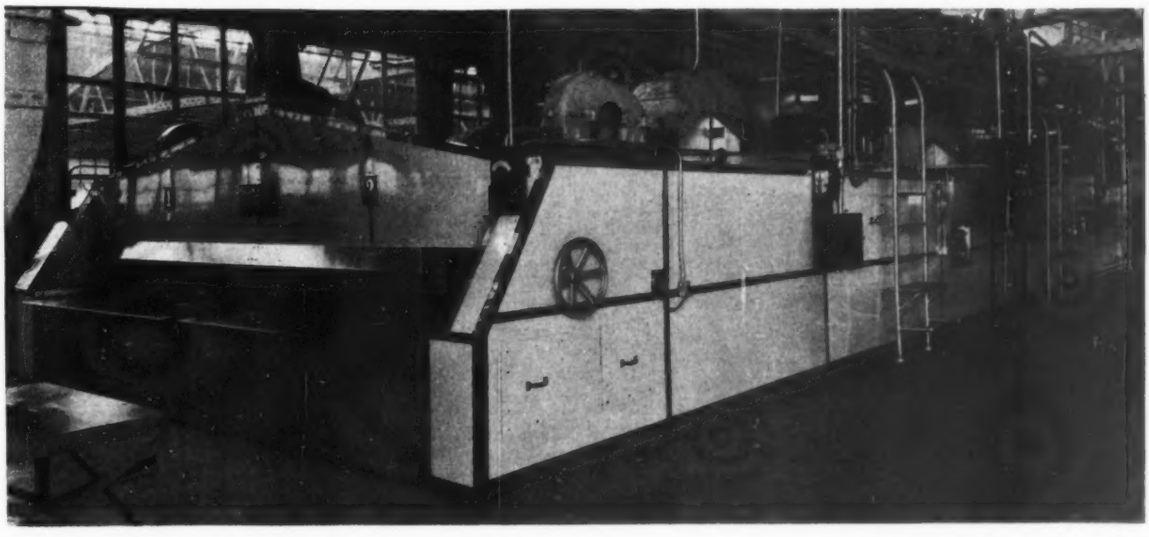
Terne plate is a suitable material for many difficult drawing and forming operations in punch presses, due to the fact that the lead-tin coating acts as a lubricant on the die surfaces. Parts can be shaped from terne plate without danger of the surface flaking or peeling. After the part has been formed, the tin-lead coating guards against corrosion of the steel base.

Sheets of terne plate are made as large as 48 by 144 inches, and in gages from No. 12 to No. 30, inclusive, for use in manufacturing articles. Such large sheets are known as "long ternes" whereas the 20- by 28-inch sheets used in roofing are known as "short" or "small" ternes. Long ternes are made in different base-metal finishes.

## Stainless Steel Protects Airplanes of the British Navy

Airplanes assigned to naval aircraft carriers are especially subject to corrosion, due to the ravages of salt air and water. According to the *Enduro Era*, published by the Central Alloy Division of the Republic Steel Corporation, the British Navy has succeeded in overcoming this handicap by constructing the entire frame and covering of fighting biplanes from stainless steel. Even the wings are covered with stainless steel in a thin sheet form. Tests have shown that the stainless steel structure of these planes will be fully resistant to corrosion under the most severe conditions likely to be encountered in naval service.

***Corrosion-resistant Steel is Employed in Building the Largest Biscuit and Cracker Oven in the World. Heat- and Acid-resistant Allegheny Metal is Used for the Outside Trim, Combustion Chamber Linings, and Internal Ducts. This Oven, Built by the Baker-Perkins Co., is 61 Feet Long and 16 Feet Wide***



# NEW TRADE LITERATURE

***Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.***

## Steel

UNION DRAWN STEEL CO., 232 Harsh St., Massillon, Ohio. Steel Handbook No. 34 for Machine Tool Users, containing a collection of data designed to aid the steel user in selecting the right steel for the right purpose and in securing the highest efficiency in his production processes. The contents comprise: Analysis of Various Grades of Steel; Cold-finished Steel Properties, Surfaces, and Sizes; Cutting Speeds and Feeds for Standard Tools; Decimal Equivalents; Decimal Sizes for Drills; Distance Across Corners of Hexagons and Squares; Grinding Die Chasers; Metric Equivalents; Physical Properties of Various Grades of Steel; Revolutions per Minute of Spindles at Given Surface Speeds for Work of Various Diameters; Characteristics of Carbon and Alloy Steels; Surface Speeds for Various Grades of Steel on Automatic Screw Machines; Tap Drill Sizes; Thread Elements; Weights of Rounds, Squares, and Hexagons; and Wire Gages.

## Contract Manufacturing

SCOVILL MFG. CO., Waterbury, Conn. Booklet entitled "Masters of Metal," telling the story of Scovill in three parts. The first part, entitled "Custom Tailors to Industry," describes the contract manufacturing business done by this concern, which embraces 300,000 different made-to-order products; the second part describes the raw materials used in manufacturing the various products; and the third part tells about the five subsidiaries and divisions of the company and the work each one is especially qualified to handle. This book is an especially beautiful example of the printing art.

## Welding and Cutting Equipment

LINDE AIR PRODUCTS CO., 30 E. 42nd St., New York City. Revised edition of a pamphlet entitled "Precautions and Safe Practices," containing information on the proper storage, care, and handling of oxy-acetylene welding and cutting equipment. Pamphlet entitled "Recommended Practices for Gas Cutting of Structural Steel," outlining qualification tests for the predetermination of good workmanship and giving safety precautions to be observed in using the gas cutting process.

## Milling Machines

VAN NORMAN MACHINE TOOL CO., Springfield, Mass. Bulletin describing the advantages, construction, and application of the Van Norman No. 12 miller. A full-page illustration of the machine is shown, on which every part is clearly designated, and a detailed description of the various parts is given. The typical set-ups illustrated, showing the machine arranged for vertical, horizontal, and angular milling, indicate the flexibility of the machine and the wide range of work for which it is adapted. Complete specifications are included.

## Motor Drives

MANLEY PRODUCTS CORPORATION, 333 State St., York, Pa. Series of bulletins describing the application of Remco motor drives to different classes of machines, including lathes, milling machines, shapers, drill presses, and miscellaneous tools. The bulletins describe how these motor drives can be applied to machines in use in order to modernize them. The various features of the different drives are pointed out and typical applications shown.

## Tumbling Barrels

GLOBE MACHINE & STAMPING CO., 1210 W. 76th St., Cleveland, Ohio. Catalogue B-4, illustrating and describing in detail the Globe new design tilting-tumbling finishing barrels. Tables of sizes, weights, capacities, and motor specifications for the various equipments are included. The partial list of users given is indicative of the wide scope of metal cleaning and finishing work for which this equipment is adapted.

## Portable Electric Tools

BLACK & DECKER MFG. CO. and VAN DORN ELECTRIC TOOL CO., Towson, Md. Loose-leaf catalogue containing illustrations, brief descriptions, and tables of specifications covering the Black & Decker-Van Dorn super-power high-cycle portable tools, which are especially applicable to production work, due to the fact that they maintain uniform speed and power under load, which results in faster production.

## Sheet Iron

REPUBLIC STEEL CORPORATION, Youngstown, Ohio. Fifth edition of a "Sheet Iron Primer" known as Bulletin 127. The book contains 64 pages telling the step-by-step story of the modern manufacture of sheet iron, tracing the production from the ore mine to the final inspection of the completed sheet. Iron and steel sheet gage tables are given and a glossary of metallurgical terms is included.

## Belting and Packing

NEW YORK BELTING & PACKING CO., Passaic, N. J. Mechanical rubber goods catalogue, containing a fund of practical information about hose, belting, packing and miscellaneous mechanical rubber products. Illustrations and complete information are given about each product so that it can be applied to the best advantage. Diagrammatic drawings give a clear idea of various applications.

## Boring, Drilling, and Milling Machines

GIDDINGS & LEWIS MACHINE TOOL CO., Fond du Lac, Wis. G & L 30 Series catalogue, describing the constructional features and the standard

and special equipment of the high-power precision horizontal boring, drilling, and milling machines made by this concern. Complete specifications for the various sizes and styles of machines are included.

## Turret Lathes

JONES & LAMSON MACHINE CO., Springfield, Vt. Catalogue 34-107, illustrating and describing in detail the J & L ram type universal turret lathes. In addition to a complete description of the various parts and attachments, general specifications are given covering the two sizes in which these machines are made, namely, 1 1/2- by 10-inch and 2 1/2- by 14-inch.

## Tension-Control Motor Bases

AMERICAN PULLEY CO., Philadelphia, Pa. Bulletin describing the principle of operation, installation, and advantages of the American "Tension Control" motor base, which is so designed as to automatically maintain the proper tension in the belt, regardless of fluctuations in the load, and thus is specially applicable to the short center flat belt drive.

## Pumps

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletins W-317-B2 and W-318-B6, illustrating and describing, respectively, Worthington single-stage volute and two-stage volute centrifugal pumps. Bulletin W-423-B2, containing a general description and specifications covering Worthington automatic power pump receiver sets.

## Steel Tubing

TIMKEN STEEL & TUBE CO., Canton, Ohio. Bulletin containing a series of Master Weight Tables for round steel tubing. Weights per lineal foot of length are given for all sizes of hot-finished and cold-drawn tubing having an outside diameter of from 1/16 inch up to 10 3/4 inches and a wall thickness varying from 36 B.W.G. up to 1 5/8 inches.

## Tool-Room Equipment

DAYTON ROGERS MFG. CO., 1845 E. Franklin St., Minneapolis, Minn. Circular illustrating and describing the new improved precision combination angle-plate and "Holocator" for drilling, locating, measuring, checking, and laying out small precision tool-room work. Circular outlining the small-lot stamping service offered by this concern.

## Gas Engines

MERIAM CO., 1955 W. 112th St., Cleveland, Ohio, in collaboration with the Socony-Vacuum Oil Co., has brought out a pamphlet containing operating instructions, oil and lubrication data, etc., for users of Meriam rebuilt gas engines. The practical information and diagrams given are designed to assist gas engine users generally.

## Cold-Drawn Tubing

SUMMERILL TUBING CO., Bridgeport, Montgomery Co., Pa. Leaflet describing in a non-technical way the manufacture of cold-drawn seamless steel tubing, including the preparation for drawing, cold-drawing, annealing, and final operations. Circular listing some of the tubing specialties produced by this concern.

## Portable Drafting Machines

FLETCHER F. MILLIGAN CO., 4614 Prospect Ave., Cleveland, Ohio. Circular descriptive of the "Junior Draft-Kit," a low-priced portable drafting machine, especially useful for salesmen, engineers, superintendents, foremen, contractors, builders, and others who have occasion to make sketches while traveling about.

## Laboratory Equipment

BAUSCH & LOMB OPTICAL CO., Rochester, N. Y. Bulletin D-215, descriptive of a new density comparator for rapid quantitative spectrographic analysis. Bulletin D-228, entitled "Something New in Spectrographs," descriptive of the small Littrow spectrograph for use in scientific and industrial laboratories.

## Foundry Equipment

WHITING CORPORATION, Harvey, Ill. Bulletins entitled "Fifty Years of Service to Foundries"; "Better Cores in Less Time at Lower Cost"; "— And Now a Better Ladle by Whiting"; "Collecting Foundry Dust the Modern Way"; "Whiting Counter-balanced Roller Bearing Tumbling Mills"; and "Turntables."

## Alloys

MOLYBDENUM CORPORATION OF AMERICA, Pittsburgh, Pa. Circular containing an article entitled "Alloys in the Ferrous Foundry," giving information on the influence of chromium, molybdenum, and tungsten additions to cast iron. The effects are shown graphically by means of charts and photomicrographs.

## Forgings

KROPP FORGE CO., 5301 W. Roosevelt Road, Chicago, Ill. Circular entitled "Forging the Impossible," showing examples of unusual forgings produced by this company. A partial list of Kropp-made forgings gives an idea of the scope of the process and the service that this company is in a position to render.

## Electric Motors

IMPERIAL ELECTRIC CO., Akron, Ohio. Bulletin 1020, entitled "A Service to Manufacturers Who Build Motor-Driven Machines," illustrating the application of motors to various types of drives and outlining the reasons why the small manufacturer can render a specialized service on such drive problems.

## Optical Gaging and Inspection Tools

ADAM HILGER, LTD., 98 Kings Road, Camden Road, London, N.W.1, England. Bulletin illustrating and describing the angle "Dekkor" and other optical tools for mechanical and engineering gaging and inspection. Various specific applications of these tools are described.

## Graphic Recording Instruments

ESTERLINE-ANGUS CO., Indianapolis, Ind. Pamphlet 1305 in a series entitled "Solving Industrial Crimes." This series of pamphlets describes different concrete cases of waste through excessive current consumption and shows how this waste can be avoided by the use of graphic recording instruments.

## Welding Machines

LINCOLN ELECTRIC CO., Cleveland, Ohio. Welder Specification Bulletin No. 304, containing general specifications for the engine-driven Type SA300 "Shield Arc" welder.

Welder Specification Bulletin No. 305, containing specifications for the engine-driven Type SA400 "Shield Arc" welder.

## Surfacing Machines

PEERLESS SURFACING MACHINE CO. Division of Production Machine Co., Greenfield, Mass. Circular illustrating and describing Peerless abrasive-belt surfacing machines of horizontal and vertical types for grinding and sanding flat surfaces of metal, wood, hard rubber, celluloid, and molded composition.

## Grinding Wheels and Points

A. P. DE SANNO & SON, INC., 1612 McKean St., Philadelphia, Pa. Bulletin covering "Radiac" permanently mounted grinding wheels and points. A general description of the construction and characteristics of these tools is followed by illustrations of the many types available, together with full specifications.

## Hacksaws

CLEMSON BROS., INC., 10 Star St., Middletown, N. Y. Booklet containing useful information on metal cutting with hacksaws. The material covers selection of saw blades and teeth, proper application, speed and feed, causes of trouble and methods of correction, and hacksaw machines.

## Oil Seals

GARLOCK PACKING CO., 10 Center St., Palmyra, N. Y. Catalogue describing the Garlock "Klozure," an improved oil seal for retaining oil and grease in a bearing and excluding dust and dirt. Information on applying the Klozures and a list of standard sizes are included.

## Washfountains for Industrial Use

BRADLEY WASHFOUNTAIN CO., 2203 W. Michigan St., Milwaukee, Wis. Bradley Blue Book, illustrating industrial installations of Bradley washfountains, group showers, and drinking fountains, and containing a partial list of users.

## Sheared Plates and Pressed Shapes

BY-PRODUCTS STEEL CORPORATION Division of the Lukens Steel Co., Coatesville, Pa. Circular showing typical examples of the sheared plates, pressed shapes, and steel blanks that have been made to order by this company.

## Couplings

ZOBELL ELECTRIC MOTOR CORPORATION, Garwood, N. J. Leaflet describing the principle of operation and the advantages of a new safety-drive coupling, which is designed to automatically shut off the motive power in case of accidental jamming or undue overloading.

## Blowers

ROOTS-CONNERSVILLE BLOWER CORPORATION, Connersville, Ind. Bulletin 22:23 - B10, illustrating and describing Roots-Connersville standard and heavy-duty blowers. The characteristics of these blowers are described and typical installations are shown.

## Electric Motors

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Leaflet 2182, descriptive of the new "Seal-Clad" induction motors with protected windings, made by this company, which are built in ratings up to 25 horsepower and 1800 revolutions per minute.

## Electric Motors

LOUIS ALLIS CO., Milwaukee, Wis., is distributing an unusual "motor price wheel," consisting of two fiber di ks about 8 inches in diameter, which quickly and accurately tell the frame sizes and list prices of 448 popular sizes and types of electric motors.

## Abrasive Products

NORTON CO., Worcester, Mass., is distributing a handy little device for sharpening pencil points, consisting of a pad with different forms of abrasives on each leaf, illustrating the various styles of "Non-Slip" tiles and treads made by the company.

## Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletins GEA-1137B, 1327A, and 1585A, illustrating and describing, respectively, indoor alternating-current cubicle switch-gears; indoor disconnecting switches; and high-voltage magnetic switches.

## Lubricants

NATIONAL MOTOR BEARING CO., INC., 1100 Seventy-Eighth Ave., Oakland. Calif. Bulletin describing typical industrial applications of National oil, grease, and fluid seals for positive permanent closures around rotating or reciprocating shafts.

## Electric Control Equipment

ROLLER-SMITH CO., 233 Broadway, New York City. Catalogue 8, illustrating and describing the line of switchgears made by this company, which includes control panels, cubicles, metal-clad units, switch houses, and special equipment.

## Dust Filters

W. W. SLY MFG. CO., 4700 Train Ave., Cleveland, Ohio. Bulletin S-76, describing the new Type EC dust filter made by this concern.

## End-Mills

PUTNAM TOOL CO., 2981 Charlevoix Ave., Detroit, Mich. Catalogue 1, covering the complete line of "Hi-Speed" end-mills manufactured by this concern. The catalogue contains illustrations and tables of dimensions and prices.

## Pipe Tools

BORDEN CO., Warren, Ohio. Circular 734, covering the complete line of modernized Beaver pipe tools, including ratchet and plain pipe-threading tools, reamers, square-end cutters, and pipe machines.

## Electric Furnaces

DETROIT ELECTRIC FURNACE CO., 825 W. Elizabeth St., Detroit, Mich. Circular announcing a small electric melting furnace with automatic rocking device intended for small production runs or test heats.

## Belt Drives

CHICAGO BELTING CO., 113 N. Green St., Chicago, Ill. Circular describing the advantages of Chicago tension-welded leather belting and flat leather-belt short-center drives.

## Lubricants

ACHESON COLLOIDS CORPORATION, 2015 Washington Ave., Port Huron, Mich. Bulletin 220, dealing with the subject "Graphoid Surfaces and the Part They Play in Lubrication."

## Gas Engines

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletin S-550-B6, illustrating and describing Worthington vertical four-cycle gas engines.

## Gate Valves

FAIRBANKS CO., 393 Lafayette St., New York City. Folder containing data on Fairbanks bronze and iron body gate valves with renewable bronze seat rings.

## Portable Cranes and Hoists

CANTON FOUNDRY & MACHINE CO., Canton, Ohio. Booklet descriptive of Canton portable floor cranes and hoists provided with safety friction load brakes.

## Boiler Plate

LUKENS STEEL CO., Coatesville, Pa. Pamphlet containing specifications for chrome-manganese-silicon alloy steel boiler plate.

# *Shop Equipment News*

*Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market*

## Wickes Broaching Lathe for Finishing External Cylindrical Surfaces

Cylindrical surfaces and adjoining faces are finished accurately and rapidly by the broaching process on a new machine that differs radically in design from the conventional types of machine tools for turning and facing operations. In this machine, the work is revolved on its axis during the broaching operation. The new machine, known as the Wickes "broaching lathe," is a development of Wickes Bros., Saginaw, Mich. There are patents pending covering the new features.

The machine has been developed for rough- and finish-turning, filleting, facing, and shouldering the external cylindrical surfaces of various machine parts. The part shown in the machine illustrated is a cast alloy crankshaft. The operation consists of turning the three main bearings, filleting and facing the cheeks, and finishing the outside diameter of the pulley adjacent to the front bearing. The machine is arranged for performing both the roughing and finishing operations at one stroke of the broaches. The work performed by the broaches is very accurate with regard to roundness and size. The broaches are about 4 1/2 feet long and are designed to provide free cutting at all times and to carry the chips away from the fillets and shoulders. Some of the chips produced on this machine from a cast alloy crankshaft are shown in Fig. 2.

Among the outstanding features of the broaching lathe are high production and long life of the broaches. It is claimed that one reason for the high production obtainable is the small amount of time required for tool changes, since wear on the broaches is almost negligible. The broaches will produce from 50 to 100 times the number of pieces per grind that can be obtained with the best high-speed tool bits. A broach has been used in actual production for over a year by several companies in broaching the center bearing of a crankshaft from the rough. A production of 5000 to 8000 forged parts was obtained for each sharpening of the broaches used for this work.

The machine is equipped with hydraulic chucks and is semi-automatic in operation; that is, after each crankshaft has been secured in the hydraulic chuck, it is merely necessary for the operator to push the starter button, after which the machine goes through the rough- and finish-broaching operation, stops automatically in the unloading position, and automatically unloads the crankshaft from the hydraulic chucks into the loading fixture; the slide that carries the broaches then returns to the starting position and stops auto-

Fig. 1. Three Main Bearings of a Crankshaft are Turned, the Cheeks Filleted and Faced, and the Outside of the Pulley Turned at One Pass of the Broaches on the Wickes Broaching Lathe

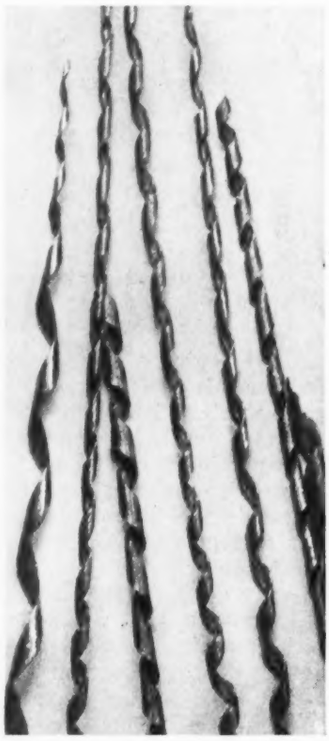


Fig. 2. Chips Produced by Wickes Broaching Lathe

matically in this position, ready for the next operation.

The feed to the broach slide is through a very large-diameter screw and a heavy bronze nut which is adjustable for wear. The machine is equipped with anti-friction bearings throughout, including the main spindles. It is of the double-end drive type with herringbone gears mounted on the main spindles. Automatic force-feed lubrication is employed.

The main drive is by means of a 20-horsepower motor, with a 10-horsepower motor for the feed to the broach slide. A 2 1/2-horsepower motor is used to drive the pump for the hydraulic chucks and steadyrest. The machine weighs 41,000 pounds.

## Hut-O-Lap Gear-Lapping Machine

The Hut-O-Lap "inclined axis" method of lapping and the machine and laps for applying this new method to the precision lapping of spur, helical, or herringbone gear teeth are recent developments of the Hutto Engineering Co., Inc., 515 Lycaste Ave., Detroit, Mich. Application of the inclined axis principle to the lapping of a helical cluster gear is illustrated in Fig. 2, the lapping machine itself being shown in Fig. 1. This machine is designed for the lapping of heat-treated gears to unusually close tolerances in order to give quieter and smoother gear operation, with correct tooth contact.

In this machine the axes of the lapping members are inclined relative to the axis of the work piece in such a manner that the normal line of rolling contact is transferred from one that is parallel to the axis of the work piece to one that diagonally intersects the conventional pitch line. This results in a complete lapping action throughout the entire gear tooth height and width. An extremely slow longitudinal reciprocating motion is used solely for the purpose of distributing the abrasive effect uniformly over the face of the gear tooth.

Two lapping members are employed at diametrically opposite sides of the work piece in combination with a supply of suitable abrasive material. The driven lapping member, through engagement with the work piece which, in turn, is driven by the driving lapping member, is retarded through a braking means. Pressure is thus brought to bear upon opposite flanks of the work piece tooth to assure the desired abrading action.

The machine is completely automatic in operation, requiring the attention of the operator only for inserting and removing the work pieces. It has variable rotating speeds and an adjustable reciprocating stroke that is controlled through an electrical

Fig. 1. Hutto "Inclined Axis" Precision Gear-lapping Machine

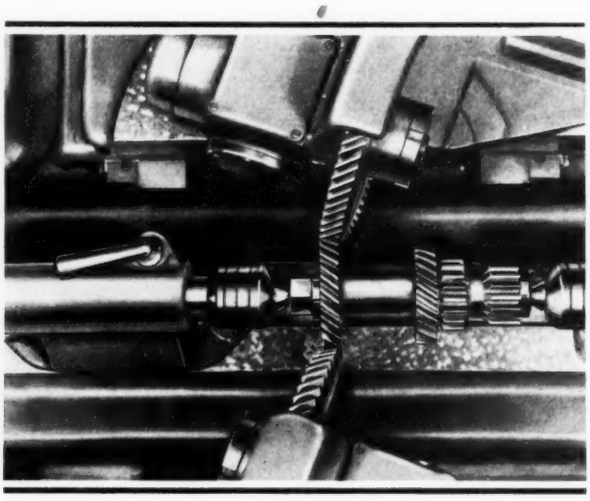


Fig. 2. Helical Cluster Gear in Lapping Position between Two Lapping Members

timing device. This mechanism makes possible predetermined rotating and reciprocating speeds to suit the particular gears to be lapped. Thus one operator can attend to a battery of machines.

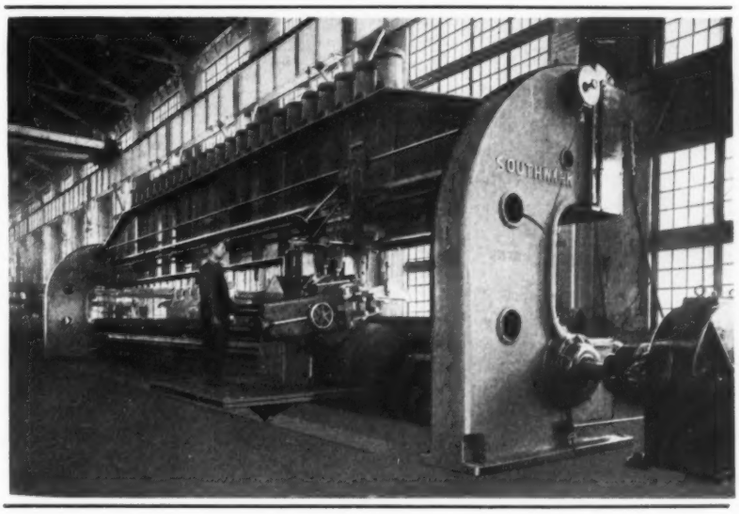
Work up to 8 inches in diameter and 12 inches in length can be handled on this machine. Multiple lapping members may be engaged with a multiple type work piece gear, such as a cluster or herringbone gear, making possible simultaneous lapping of two or more gear members on this type of gear. The maximum diameter of lap is 9 inches, and the maximum travel of the reciprocating stroke is 5 inches. The depth of the machine, front to back, is 52 inches, and the width, 48 inches. The over-all height is 48 inches, and the net weight, 3100 pounds.

## Southwark Heavy-Duty Plate Planer

A heavy-duty planer with a capacity for planing steel plate 36 feet long by 4.7 inches thick has just been completed by the Southwark Division of the Baldwin-Southwark Corporation, Philadelphia, Pa. This planer is to be used for edge-planing and scarfing plates for some of the new vessels of the United States Navy. It has several unique features and is arranged to handle heavier plates with a deeper "scarf" than any machines previously built, it being possible to plane an 18-inch scarf or slope on the edge of plates 36 feet long.

The cutting speed varies from 15 to 45 feet per minute. Cuts are made in both directions of travel. The tool feed is from 1/128 inch to 1 inch per cut. The maximum vertical adjustment of the tool is 10 1/2 inches, and the maximum horizontal adjustment 24 inches. The drive screw, which is 7 inches in diameter by 58 feet long and has a quintuple thread, runs in roller bearings.

A 50-horsepower motor drives the machine, all controls being operated from the tool carriage, on which the operator rides from one end of the plate to the other. Pneumatically operated hold-down clamps having a capacity of 120 tons serve to hold the plate in place. Pressure lubrication is used, and many of the wearing surfaces are of hardened steel. Both the machine and the operator are fully protected from injury by safety devices that are incorporated in the design of the machine.



Heavy-duty Plate Planer Built by the Baldwin-Southwark Corporation

Sawing and Filing Diemaking Machine

## Foley Diemaking Machine

The diemaking machine here illustrated is being placed on the market by the Foley Mfg. Co., Inc., 11-15 Main St., N.E., Minneapolis, Minn. This machine is designed for sawing and filing operations on dies, but many other metal-working operations can also be performed. Perhaps the most outstanding feature is the provision for swiveling both the head and the table in order to obtain any combination of angles desired. The head can be swiveled 20 degrees either to the right or to the left, while the table can be tilted 20 degrees toward the front and 10 degrees toward the back. At the points where these adjustments are made, wrenches are permanently attached to the adjusting nuts, so that the operator does not waste time in hunting for wrenches of the proper size.

Another convenient feature has been obtained by making the hold-down and the air nozzle integral. This facilitates making adjustments or settings and permits a clear view of the work.

If the machine is arranged for filing, it can be quickly changed over into a sawing machine, or vice versa. This may be done by interchanging the saw- and file-holding arms on the ram or by merely changing the holders in the front end of the arms. Any file or saw can be accommodated.

Another feature is a saw-feed guide at the right-hand end of the table which enables the work to be swiveled easily for cutting irregular shapes, curves, etc. The stroke of the machine can be adjusted from 0 to 4 inches. The equipment is portable and self-contained, so that it can be plugged in wherever current is available. It weighs 322 pounds.

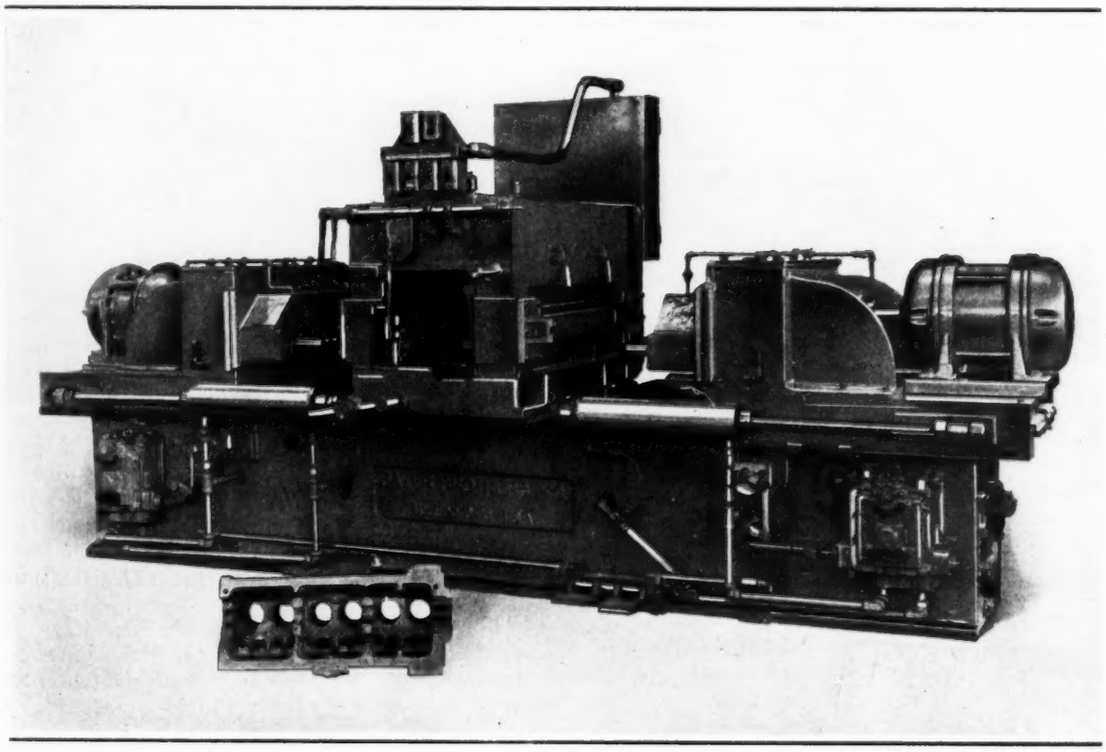
There is an adjustable gib on the ram for taking up wear. Air for blowing chips away from the tool is supplied by a pump that is driven from the crankshaft of the machine. The saws are backed up by a roller guide in which rollers are provided on each side of the saw, as well as in back. The overhead adjustable light seen in the illustration is standard equipment. The machine has a 6 1/2-inch throat and will saw to the center of a 13-inch piece and saw or file steel work up to 3 inches thick. Four speeds are available, ranging from 95 to 400 revolutions per minute. Power is supplied by a 1/4-horsepower motor.

## Baker Two-Way Hydraulic-Feed Drilling and Boring Machine

A two-way hydraulic-feed drilling and boring machine having multiple-spindle heads on each opposed saddle has been developed by Baker Bros., Inc., Toledo, Ohio, for work requiring extreme accuracy combined with high production and flexibility of the equipment. The machine illustrated is equipped with a twelve-spindle head on each saddle for use in drilling the valve guide and tappet holes in a six-cylinder motor block. A second machine of the same kind is used for two-way boring of the drilled holes. The latter machine has heads and fixtures of the same design as the first machine, but the tools used are of the multiple-blade, end-cutting type.

An oil sump is incorporated in the bed at each end. Both the pumps and their individual driving motors are enclosed in the bed. These two oil-pumps, one for each end, provide an independent hydraulic-feed system for each opposed head. The driving motors at the rear are readily accessible. The Baker "Twin-Pull" feed cylinder mounting is used to furnish movement for each saddle. The cylinders give an available feeding pressure of 18,500 pounds to each head.

The hydraulic pumps have sufficient capacity to give a rapid traverse speed forward of 220 inches per minute and a return rapid traverse speed of 180 inches per minute. The multiple-spindle heads are mounted on



Baker Hydraulic Drilling and Boring Machine Equipped with Two Twelve-spindle Opposed Heads for Operations on Cylinder Blocks

drive brackets secured to saddles, each of which is 40 inches long. This design has been developed to facilitate changing the machine to suit different kinds of work. Automatic lubrication is provided for the gears and bearings in both drive brackets and multiple heads.

The fixture is of the tunnel type with provision for using a tumble type conveyor to facilitate rapid handling of the cylinder block. The cylinder block is chucked on its side, being located by two dowel-pins in the pan rail surface. Clamping is done hydraulically. Auxiliary hand supports are provided at each end of the block. The tool support bushing plates are mounted on the fixture and are moved in and out through the medium of an oil cylinder. The support bushings are located close to the work at the start of the cuts. The two levers at the upper left of the fixture control the clamping and moving of the support plates. The machine performs its cycle of operations automatically. A separate hydraulic system is furnished for operating the fixture.

## National Acme Six-Spindle Automatic Screw Machine

To meet the need for standardized machines that are very flexible in their application and can be readily changed from one product to another, the National Acme Co., 170 E. 131st St., Cleveland, Ohio, is introducing a new line of six-spindle automatics to be known as the Model R. This new line will supplement the four-spindle automatic screw machines announced in May, 1934, MACHINERY, page 563.

The six-spindle and four-spindle Model R machines are built on the same frames and are uniform in design. As far as possible, the machine parts, tooling, and attachments have been made interchangeable. The collets and pushers for corresponding sizes of machines are interchangeable. The new six-spindle machines are built in four capacities: 9/16, 1, 1 1/4 and 1 5/8 inches. An important feature of the six-spindle machine is the arrangement or spacing of the spindles in the spindle carrier. The two spindles at the top and the two at the bottom are in line for direct application of tooling from the four heavy, independently operated cross-slides. The two spindles at the sides—second and fifth positions—are accessible for a "short coupled" double-deck tool-holder or an independent cross-slide if required.

Stock stops are regularly provided in the sixth position, but the machine can be furnished with the stock stop in the first position. The stop is brought into position by a mechanism that is entirely enclosed and that drops quickly out of the way after the stock feeds out and the collet closes, making possible

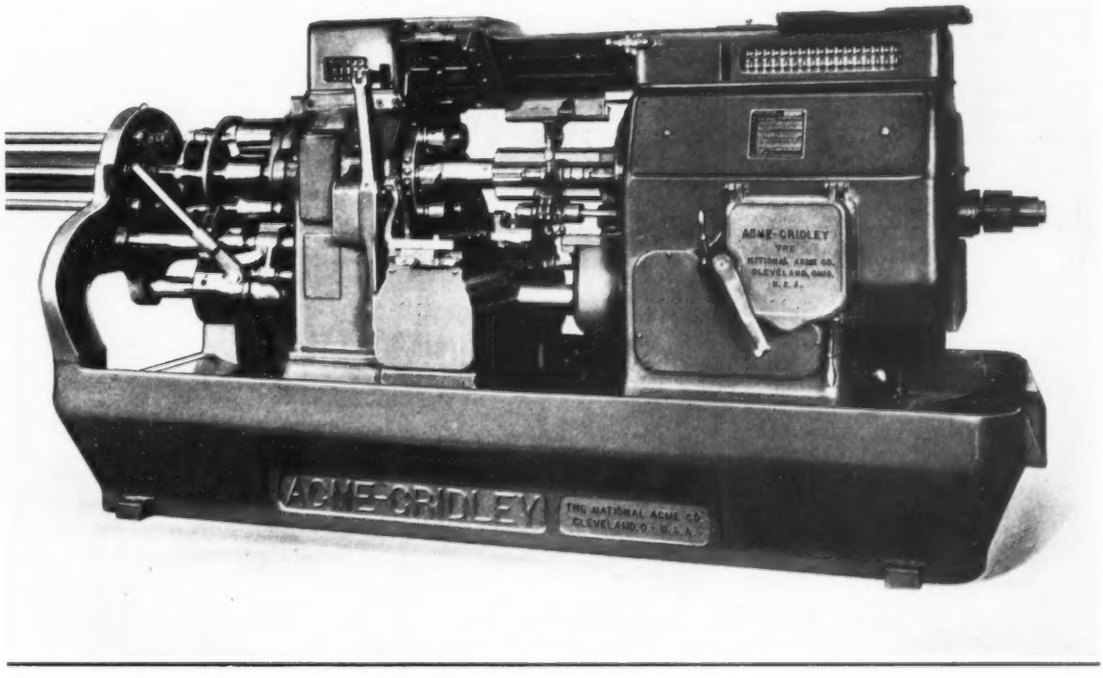



Fig. 1. National Acme Six-spindle Automatic Screw Machine Designed to Facilitate Changing Tools for Replacement or Change in Product

the use of tooling in the feed position. Thus all six positions are actually working positions which, in combination with the four independent cross-slides, makes the six-spindle machine equivalent to one having a greater number of spindles. The stock reel is indexed by power through a shaft and gear from the spindle-carrier mechanism to eliminate torsional strains and whipping action of the spindle carrier. The stock tubes are mounted in anti-friction bearings and revolve with the bar stock. A finger holder of new design for opening and closing the collets is furnished with these machines. The fingers slide on a hardened cam inside the outer steel shell. Both the fingers and the shell rotate with the spindle. This eliminates excessive wear on the fingers.

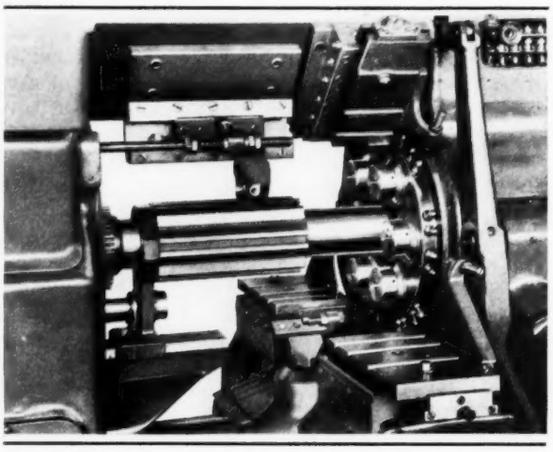


Fig. 2. Close-up View Showing Ample Tool Space Available on Machine Illustrated in Fig. 1

Provision is made for driving each individual forming tool and drill at its correct surface speed. High-speed drilling attachments can be used in any or all of the six positions. The six-spindle Model R is arranged to thread in the third or fourth position or in both, and the same slide and operating mechanism in either position can be used for accelerated reaming or turning operations. These two die slides are independent of the main tool-slide and of each other, being operated by separate cams. There is a sight-feed oiler for each oil-tube. The oiler operates only when the machine is running.

## Lincoln Alternating-Current Welder

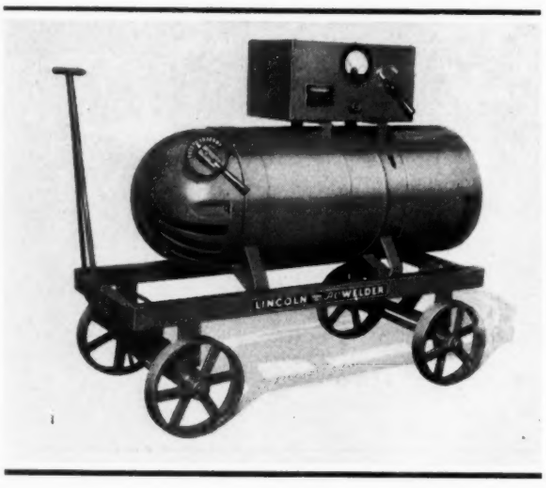
An alternating-current welder known as the Lincoln "Shielded Arc AC" has been announced by the Lincoln Electric Co., Cleveland, Ohio. This welder is of the motor-generator type which takes two-phase or three-phase alternating current of standard voltages and frequencies and converts it into alternating current of lower voltage and at the higher frequencies most suitable for arc welding with either heavily coated or washed electrodes.

The new welder is built in portable and stationary alternating-current motor-driven models and in two sizes. The smaller capacity machine can be used for continuous welding with electrodes of 3/32 to 5/16 inch in size. The larger capacity welder handles electrodes from 1/8 inch to 3/8 inch in size.

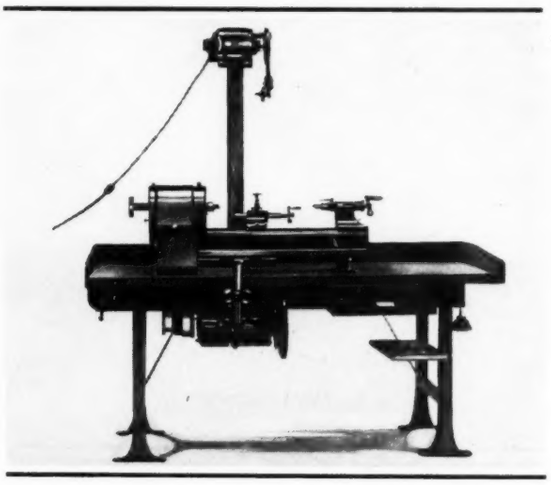
These machines are wired for 220, 440, or 550 volts, alternating-current supply, two- or three-phase, 50 and 60 cycles. This welder is similar in appearance to its companion machine built for direct-current welding.

## Rivett Enclosed Head Lathe with Speed-Box

An enclosed head with a hinged cover which gives access to the cone pulley to permit holding or turning the spindle when indexing, measuring, or locating work,




Lincoln "Shielded Arc AC" Welder



Rivett Lathe with Enclosed Head

is a feature of the precision bench lathe recently added to the line of machines built by the Rivett Lathe & Grinder Corporation, Brighton, Boston, Mass. Other features are: Removable end plate which permits replacement of the endless belt on the cone pulley; precision taper roller bearings with take-up to compensate for wear; speed-box drive with either a hand lever control or a two-latch foot treadle control for the selective high- and low-range speeds.

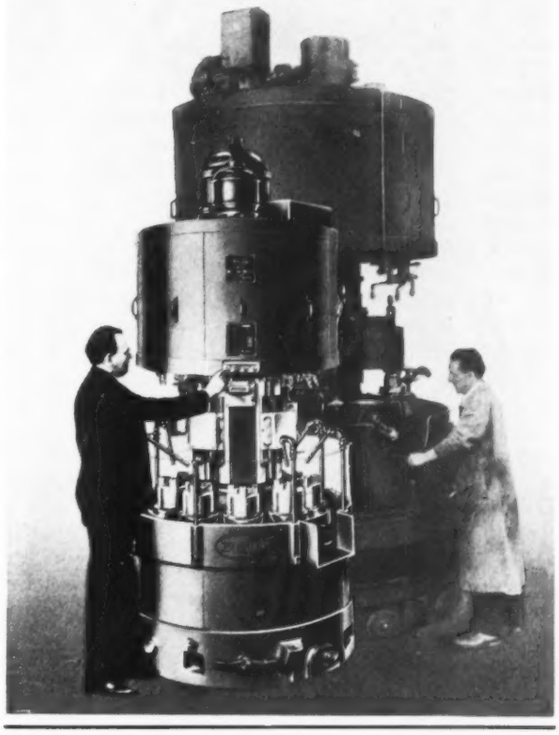
When used with the 3/4-horsepower motor recommended, the drive unit is available for 6, 12, or 18 selective forward or reverse speeds in steps from 200 to 3000 revolutions per minute. The speeds obtainable in the standard low range without shifting the motor V-belt on the steps of the driving sheave are 200, 285, 420, 600, 850, and 1250 revolutions per minute. The high-range speeds provide for machining small-diameter work with tungsten-carbide or diamond tools. Simply touching the speed-box lever serves to disengage it from the high- or low-speed range position. The automatic brake simultaneously stops the driving cone pulley without stopping the motor.

The illustration shows the lathe mounted on a bench with a speed-box motor drive and an adjustable upright with a unit motor drive for operating grinding attachments. The length of the bed is 38 inches; the distance between centers, taken with the tailstock flush with the bed, is 17 inches; and the swing over the bed, 8 inches. The diameter of the draw-spindle hole is 1 inch.

The bed is supported on pedestals having screw adjustment for raising and lowering the lathe for tensioning the belt on the cone pulley.

## Bullard Small "Type J" Mult-Au-Matic

In order to extend the advantages of the Mult - Au - Matic method of machining to smaller work, the Bullard Co., Bridgeport, Conn., has developed a new series of eight-spindle Mult-Au-Matics known as the J series. This series is designed for the field of small high-speed work, and the two machines J-7 and J-11, with capacities of 8 and 12 inches, respectively, offer all the advantages of the larger Mult-Au-Matics; in addition, they have many features not incorporated in the larger machines.



Bullard Mult-Au-Matic Built for Small Work

The electric control, for example, includes three conveniently located push-button stations. Each station has four separate buttons, one for emergency control which stops all functions; a second for starting the main drive motor; a third for controlling the head traverse advance; and a fourth for the head traverse return. The head traverse is operated by a separate motor.

The eight spindles allow one station for chucking and seven stations for work, with the speeds independently variable to meet the requirements at any station. The initial range of speeds for the smaller machine includes forty-one changes, from 168 to 1509 revolutions per minute. For the larger machine, the initial range includes forty-one changes, from 84 to 754 revolutions per minute. In addition to these changes, it is possible to obtain a two-to-one reduction of all spindles by a dual range change feature. The rates of feed per revolution of the spindle are the same for both machines. The range includes forty-one changes that give feeds from 0.004 to 0.036 inch per revolution.

The total maximum stroke is 10 inches. A mechanical, power-operated chuck, with built-in chucking mechanism controlled by a convenient foot-lever, is provided with adjustment for obtaining various holding pressures. A separate, easily cleaned unit, consisting of a chip container with cutting lubricant reservoir, pump, motor, and control is obtainable for use when handling work requiring cutting lubricants.

Plain tool-heads having a 10-inch vertical movement, and compound heads consisting of a single tool-slide mounted on the saddle are obtainable. The 10-inch stroke of this slide may be applied as vertical movement only or to include a maximum of 1 1/2 inches horizontal movement of the tool-slide to either the right or left. Drilling and boring heads with variable individual speeds secured by change-gears are also obtainable. The boring head is of the high-speed diamond-boring type.

The Bullard patented double-index feature may be obtained, which provides two adjacent loading stations. This permits first and second chucking operations on the same machine when the required number of operations can be performed at the six remaining stations. With this arrangement, there are three working stations for each chuck.

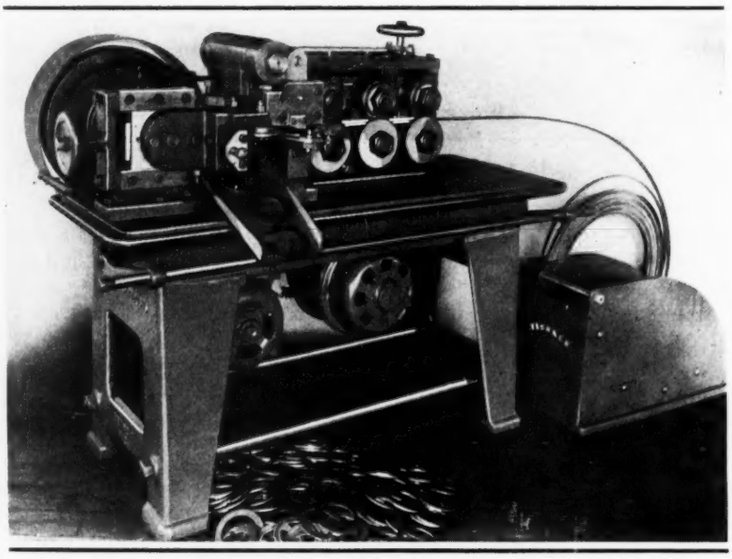
Vertically mounted, 10-horsepower direct-connected motors are used for the main drive of both machines. The traverse motor for the J-7 machine is 3 horsepower, and for the J-11 machine, 5 horsepower. The machines occupy floor spaces of 50 and 58 inches diameter. The height of the machines, exclusive of the motors, is 102 inches.

## Tishken Washer-Forming Machine

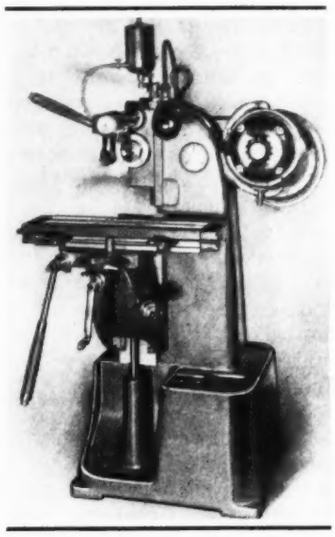
Split washers from 5 to 6 inches outside diameter are produced at the rate of 3000 an hour in an automatic machine recently built by Tishken Products, 4744 Twelfth St., Detroit, Mich. Hot- or cold-rolled stock 1/2 to 11/16 inch wide by 1/8 inch thick is handled. Three pairs of feed-rolls at the right-hand end of the machine carry the stock to the forming rolls. The upper feed-rolls of the second and third pair are assembled in a housing that rises intermittently, so as to relieve the feeding pressure when the finished washer is cut from the stock.

The feed-rolls carry the stock to three forming rolls which revolve in a horizontal plane. These forming rolls bend the stock into 1 1/2 complete circles, the stock gradually rising as a spiral. At the end of 1 1/2 revolutions, the advancing end of the stock strikes a stop and trips a vertical slide for shearing off the washer at the end of a complete circle. This leaves one-half of a circle already formed for the next washer. The cut-off washer becomes a flat ring as it falls on a chute at the front of the machine.

Two of the forming rolls are mounted on a slide that is adjustable to permit the production of different sizes of washers. Timken tapered-roller bearings and ball bearings are provided for the various rolls. The multiple-disk clutch which controls the machine can be operated from any point along the front of the table.



Tishken High-speed Machine for Forming Washers from Coiled Stock



Improved Whitney Hand Milling Machine Built by W. H. Nichols

## Whitney Improved Hand Milling Machine

The new hand miller here illustrated is an improved design of the well-known Whitney hand miller manufactured by W. H. Nichols, 48 Woerd Ave., Waltham, Mass. Like the preceding Whitney hand millers, this improved design is adapted for milling a wide variety of small parts in large or small lots. It is especially intended for use in tool-rooms where set-ups must be made quickly and easily.

The table of this machine has a working surface 4 1/2 by 21 inches, with a standard 5/8-inch T-slot in the center. The table is equipped with oil-pockets and micrometer stops, and is illuminated by an adjustable reflector lamp. It has a longitudinal feed of 10 inches and a transverse feed of 7 inches. The knee has a vertical feed of 13 1/2 inches. The vertical movement of the head is 4 1/2 inches. The table can be brought up to the center line of the spindle. There are micrometer dials on the transverse and vertical feeds, and a hand-set stop for the vertical movement of the head.

The drive is furnished by a constant-speed geared-head motor of 3/4 horsepower, which can be furnished for all voltages

ordinarily available in either alternating or direct current. For light-socket operation, a 1/2-horsepower, single-phase unit is available. The motor is reversed by means of a built-in drum switch. The drive to the spindle is through a double V-belt, which is not only adjustable for tension, but is also maintained at constant tension, regardless of the position of the head.

The spindle, of heat-treated steel, is carried on Timken precision taper bearings. The spindle nose has the new milling machine standard taper of 3 1/2 inches to the foot, which allows the tool to be easily removed by merely loosening two set-screws. Four speeds, of 100, 200, 650, and 1200 revolutions per minute, are obtained by means of interchangeable double-ratio sheaves.

The machine occupies a floor space of 39 by 33 inches, and has a height of 60 inches. The weight is 1000 pounds.

## Sullivan Portable Two-Stage Compressor

To meet the demand for a portable air compressor having greater capacity for its size and weight and lower fuel consumption than previous models, the Sullivan Machinery Co., 400 N. Michigan Ave., Chicago, Ill., has developed a Type WK-60 portable air compressor. The new compressor is a two-stage design, of the angle or V-type, with the air end cooled to reduce fuel consumption, which is also decreased by a new wafer type valve of exceedingly large port area and very low lift. The air ports and air piping have also been designed to offer minimum resistance to air flow.

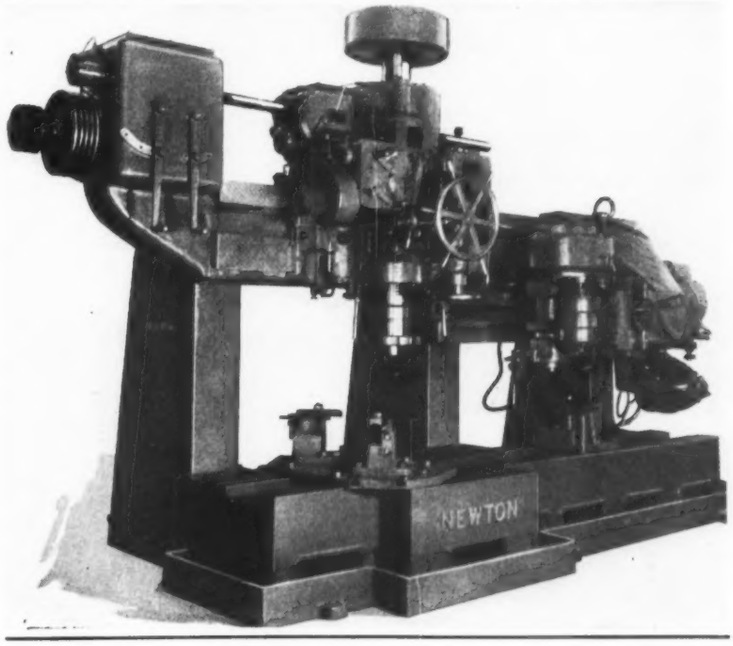
The base is welded structural steel. Ball bearings are used for the main bearings, and the number and weight of all reciprocating parts have been reduced to a minimum. The heavy-duty industrial type engines used in previous compressors of this company's manufacture are retained in the new compressor. The accessories include air cleaners and oil filters. This air compressor is now available in four sizes, all of which can be obtained with two- or four-wheel mountings and with steel or either of two kinds of rubber tires. The compressor can also be obtained mounted on a truck.

## Newton Combination Boring and Milling Machine

The Newton combination boring and milling machine here illustrated is used for boring and milling the large and small openings in connecting-rods and similar work. This machine was built by the Consolidated Machine Tool Corporation of America, Rochester, N. Y., for production work in a manufacturing plant in the Middle West. The connecting-rod is placed in a horizontal position on the worktable for boring and facing the larger end of the rod. The adjustable-unit milling head, on the right-hand side of the machine, is used for milling the rectangular opening in the small end of the rod.

The boring head, on the left-hand end of the cross-rail, used for boring and facing, is provided with power feed and quick return. The movement of a control lever in one direction engages the feed, and a movement of the lever in the opposite direction engages the power quick return. By means of an additional lever, either the feed or power rapid traverse can be reversed.

The boring spindle is driven by the motor mounted on the rear of the rail, back of the speed-change gear-box. The milling head is of the unit drive type, and the motor is mounted directly on the head, so that it is self-contained. This head is mounted on an arm to provide in-and-out feed at right angles to the cross-rail. The head can be moved laterally by feeding the arm along the rail. The coolant tank cast in the base of the machine has suitable draining facilities and a coolant pump and piping are provided for distributing the cutter coolant for both boring and milling operations. The machine is lubricated by a centralized oiling system.




Newton Boring and Milling Machine Built by Consolidated Machine Tool Corporation of America

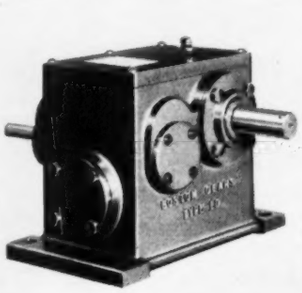


Fig. 1. Boston Type LD Speed Reducer

Fig. 2. Type MA Motorized Speed Reducer

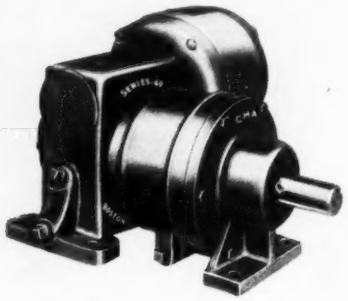


Fig. 3. Type CMA Reducer with Compound Reduction

## Boston Straight and Motorized Gear Reducers

Five new motorized speed reducers and one straight speed reducer have been added to the line of power-transmitting equipment manufactured by the Boston Gear Works, Inc., North Quincy, Mass.

The Type LD parallel-shaft straight speed reducer, shown in Fig. 1, is of practically the same design as when described in April, 1933, MACHINERY, page 554. However, it is now carried in stock in twenty ratios ranging from 37 1/2 to 1 up to 1740 to 1. This reducer has a double-reduction worm and worm-gear drive. Timken tapered roller bearings are used. The driving shaft is 1/2 inch in diameter and the driven shaft is 7/8 inch in diameter. The weight is approximately 23 pounds.

The horizontal Type MA motorized fractional-horsepower speed reducer, Fig. 2, has a single-reduction right-angle worm and worm-gear drive. This reducer is obtainable with the shaft projecting from the side opposite to the one shown or from both sides.

Like the other four motorized speed reducers shown in Figs. 3 to 6 inclusive, this speed reducer is equipped with anti-friction bearings, patented oil seals, splash-proof motors of the General Electric make, and oil-drain and oil-level plugs. It is available with either a 1/6-, 1/4-, or 1/3-horsepower alternating- or direct-current motor, and can also be furnished without the motor. It is available from stock in ratios from 3 3/4 to 1 up to 48 to 1.

The Type CMA motorized horizontal speed reducer, shown in Fig. 3, has a compound-reduction right-angle gear drive. The first reduction is by a right-angle worm and worm-gear drive, and the second by a series of spur gears. The shaft may project from the side opposite to that shown by the illustration, giving two widely different speeds to the driven shaft. It is available with a 1/6-horsepower alternating- or direct-current motor or without the motor. The standard assembly is furnished in ratios up to 5000 to 1.

The Type CVMA vertical motorized speed reducer, shown in Fig. 4, has a compound-reduction right-angle gear drive. The first reduction is by a right-angle worm and worm-gear drive, and the second by a series of spur gears. The shaft may project above the housing or in both directions, giving two widely different speeds to the driven shaft.

Fig. 4. Boston Type CVMA Speed Reducer

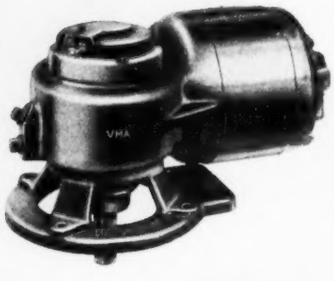


Fig. 5. Type VMA Motorized Speed Reducer

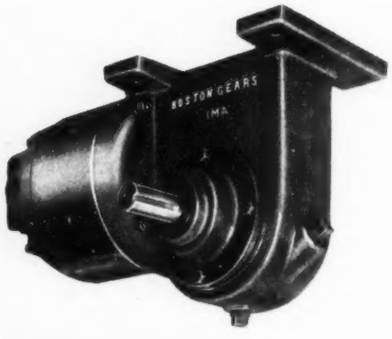


Fig. 6. Type IMA Inverted Motorized Speed Reducer

It may be supplied with or without a base, or with a base suitable for various mounting conditions. It is available with a 1/4-horsepower alternating- or direct-current motor, and can also be furnished without the motor. The standard assembly shown is available in ratios up to 5000 to 1.

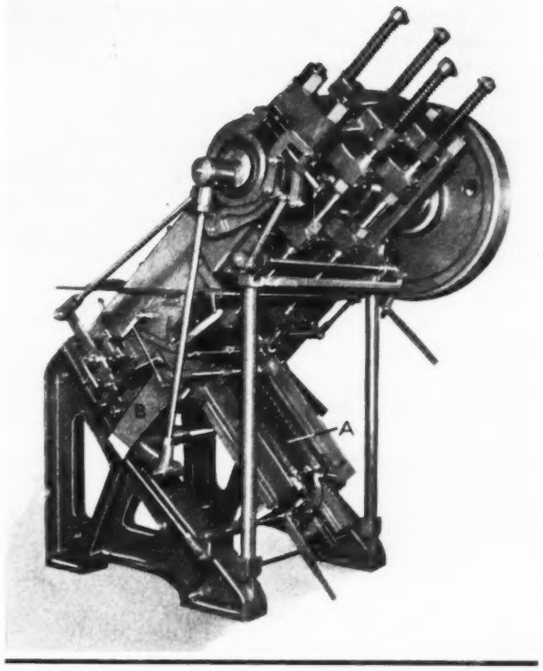
Fig. 5 shows the Type VMA vertical motorized speed reducer which has a single-reduction right-angle worm and worm-gear drive. This reducer may be obtained with the shaft projecting above the housing or in both directions. It is available with either 1/4- or 1/3-horsepower alternating- or direct-current motor, and can also be furnished without the motor. The standard assembly shown is available in ratios from 3 3/4 to 1 up to 48 to 1.

The Type IMA inverted motorized speed reducer shown in Fig. 6 has a single-reduction right-angle gear drive. The driving shaft may project from the side opposite to that shown in the illustration or from both sides. It is available with either a 1/6-, 1/4-, or 1/3-horsepower alternating- or direct-current motor, and can also be furnished without the motor. The assembly shown is available in ratios from 3 3/4 to 1 up to 48 to 1.

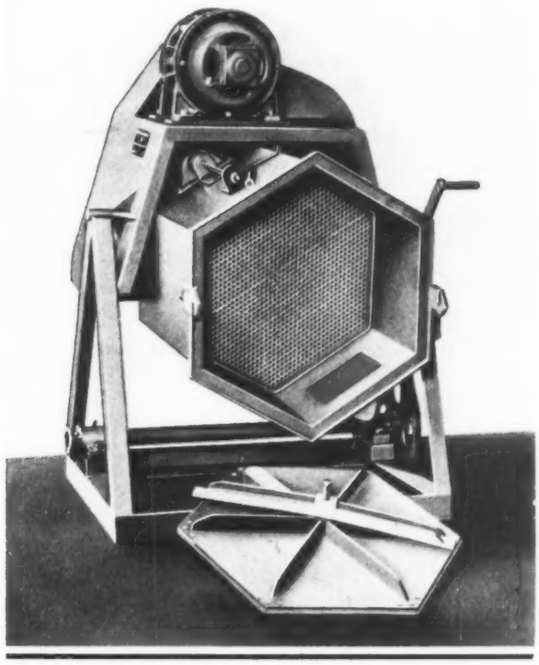
## Callahan Double-Acting Multiple-Die Press

The Callahan Can Machine Co., Inc., 80 Richards St., Brooklyn, N. Y., has recently brought out an improved model double-acting multiple-die press for producing bottle caps or similar articles. With this fully automatic press, the operator simply places a batch of tin plate, usually lithographed, in the magazine shown at *A* in the accompanying illustration. One sheet at a time is automatically fed to the dies from this magazine. The finished work is ejected through chutes at the sides of the machine, one of which is shown at *B*.

Safety devices prevent the feeding of more than one sheet at a time and also stop the machine in case of trouble. The press is driven by a 7 1/2-horsepower motor at about 95 revolutions per minute, and as it is equipped with sixteen dies, it produces 1520 bottle caps or similar articles per minute, or 729,600 caps per eight-hour day.




Callahan Multiple-die Press with Capacity for Producing 1520 Bottle Caps a Minute



Small-size Burnishing Barrel with Ball and Work Separator Made by N. Ransohoff, Inc.

## Ransohoff Burnishing Barrel for Small-Lot Work

A hexagonal burnishing barrel 12 inches deep by 24 inches side to side measurement, designed for the efficient handling of small batches, is announced by N. Ransohoff, Inc., Cincinnati, Ohio. This burnishing barrel is provided with the "Ideal" system, by which the burnishing balls and the work are automatically separated and the balls recharged into the burnishing section without manual handling, a feature previously incorporated only in barrels of large capacity.

Work as large as the barrel will accommodate may be loaded into the barrel by removing the head, which is held in place by a single central screw. Small work is loaded through the small door. The burnishing barrel is furnished with wood or 1/4-inch abrasion-resisting rubber lining or unlined.

## Toledo Drilling and Reaming Machine

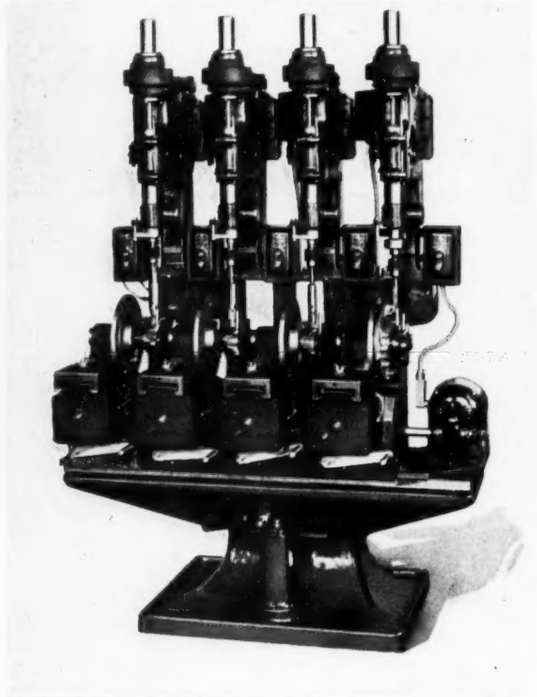
Several machines like the one illustrated have recently been built by the Toledo General Mfg. Co., 3620 Summit Ave., Toledo, Ohio, for drilling and reaming automobile clutch plates. Three sizes of clutch plates, 7, 9, and 11 inches in diameter, having three double 1/2-inch lugs with a 1/2-inch gap between them, are drilled on this machine. The drilling units are the Demco standard individual motor-driven drilling heads mounted on a special base and table. The indexing and feeding mechanism combined with the drilling head form a separate and complete unit. A rectangular cast-iron enclosure houses the feeding and indexing cam, the top forming the ways for a sliding carriage on which are mounted the vertical work-holding platen and the indexing and clamping mechanism.

When the handle shown in front of each unit is depressed, the work-holding indexing slide is moved forward 1 5/8 inches, automatically locating the work by positive stops and clamping it in place. The drill spindle then feeds downward at a rapid advance and slows up to the proper feed, advances quickly through the gap and then slows up to the proper feed for drilling the second lug, finally advancing rapidly 1 1/2 inches for reaming. A combination drill and reamer is used for the latter operation.

On the up stroke of the spindle the work-holding slide carriage returns to the starting position. In the course of this movement, the vertical work-holding platen indexes 120 degrees, which is the angular spacing between the lugs. This complete cycle is repeated three times. At the conclusion of the third cycle, the individual unit is stopped and locked for unloading and loading. The operator then depresses the handle and the three cycles are automatically repeated. All motions of the machine stop instantly when interference occurs. The indexing and feeding units are driven by a separate motor.

## Gallmeyer & Livingston Surface Grinder

A new Grand Rapids No. 35 hydraulic-feed surface grinder has been announced by the Gallmeyer & Livingston Co., 350 Straight Ave., S.W., Grand Rapids, Mich. The table has a working surface 8 by 24 inches and a hydraulic longitudinal movement of 26 inches, with a transverse movement of 9 1/4 inches. The



Machine Developed by the Toledo General Mfg. Co., for Drilling and Reaming Clutch Plates

Gallmeyer & Livingston Surface Grinder with Portable, Self-contained Coolant System

entire working surface can be traversed past the 10- by 1-inch grinding wheel.

A longitudinal table speed in excess of 100 feet per minute is available. This high table speed is for use in grinding work requiring extreme accuracy and a very fine finish. Practically any desired speed up to the maximum is instantly obtainable. The speed is controlled by a handwheel on the front of the saddle. The start-and-stop lever is located close to the speed control.

The cross-feed is automatically operated and may be set to function at each reversal of the table, or at the end of the stroke only. The cross-feed is adjustable and can be set to feed either in or out. A large handwheel provides a rapid means of raising and lowering the wheel-head. This handwheel has 0.00025-inch graduations and a pointer.

When very accurate readings are desired for grinding to close limits, the smaller handwheel or knurled knob in the center of the large handwheel, which provides a back-geared action for the elevating mechanism, is used. The disk in the center of this handwheel has a graduated dial which can be set to zero in relation to the pointer on the large handwheel. Both the inner and outer wheels turn, but the graduations on the inner wheel are arranged to read on the moving pointer, giving a vernier effect. This patented feature makes it possible to obtain readings in tenths of a thousandth with the ten-thousandth graduations over 1/8 inch apart.

The equipment includes two motors, one mounted on the base for driving the hydraulic mechanism, and the second attached to an adjustable bracket mounted on the head for driving the grinding wheel spindle through Tex-ropes. By changing the motor sheave, the spindle speed can be increased to permit using worn wheels advantageously.

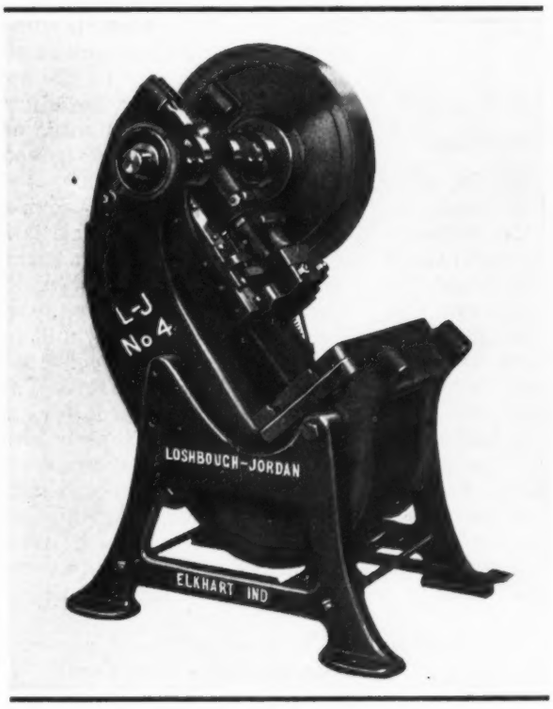
## Loshbough-Jordan No. 4 Inclinable Punch Press

An improved No. 4 inclinable punch press is announced by the Loshbough-Jordan Tool & Machine Co., Elkhart, Ind. This press is being brought out in three styles—flywheel, back-geared, and combination geared. The capacity has been raised to 35 tons by increasing the weight of the frame and the crankshaft dimensions.

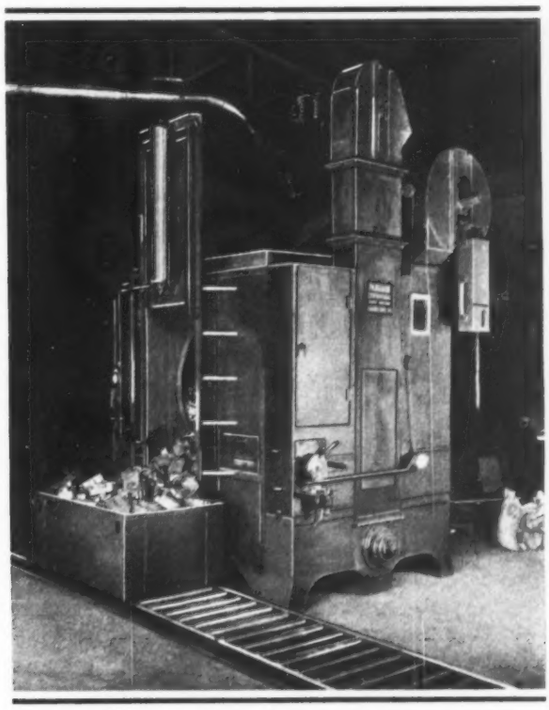
A new four-point suspension leg designed to strengthen the press frame enables the press to be inclined to a greater angle than the previous No. 4 machine. Other improvements consist of a newly designed air-cooled brake for continuous operations; an improved trip mechanism; and a redistribution of weight at points of stress on the press frame.

## Centrifugal Blast Cleaning Machine

The Pangborn Corporation, Hagerstown, Md., has developed a centrifugal blast cleaning machine for cleaning castings of various sizes and shapes without the use of compressed air. This machine cleans loads up to 18




Loshbough-Jordan Tool & Machine Co.'s Improved No. 4 Inclinable Press



Centrifugal Blast Cleaning Machine Built by the Pangborn Corporation

cubic feet in bulk, with an average weight of 2200 pounds, in from seven to fifteen minutes, depending upon the characteristics of the castings.

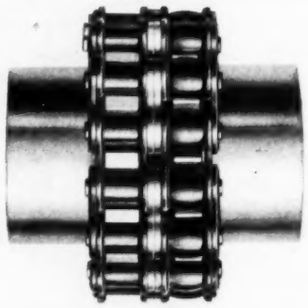
The interior of the unit has two revolving drums and a stationary "armor plate" strip through the center. The revolving drums throw the castings onto this center strip directly under the abrasive stream created by a revolving wheel. Thus, each individual casting is thoroughly cleaned, no matter how complicated the design.

The operation of this machine is very simple, the loading door being opened and closed by a quick-acting, easily controlled cylinder. An electric time clock automatically operates a warning signal when the cleaning is completed. The abrasive is used over and over again, being thoroughly cleaned and handled by the separator and elevator units built into this equipment.

## Brown Portable Potentiometer

A portable potentiometer designed to enable pyrometer users to check their potentiometers, millivoltmeters, and thermocouples quickly and accurately is announced by the Brown Instrument Co., Philadelphia, Pa. The combination of a step-switch and slide-wire makes it possible to read the indicating scale to 0.01 millivolt over a total range of 71 millivolts. This step-switch and slide-wire combination is equivalent to having a slide-wire 109 inches long. The indicating scale is 17 inches long, making the smallest division (0.05 millivolt) over 1/16 inch wide. The instrument is 9 3/8 inches wide by 10 1/4 inches deep, by 6 3/4 inches high, and weighs only 12 pounds.

Portable Potentiometer Made by Brown Instrument Co.

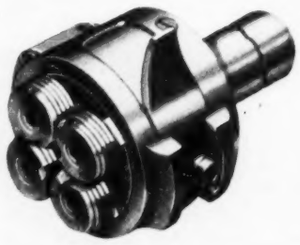


Baldwin-Duckworth Flexible Shaft Coupling

## Baldwin-Duckworth Flexible Coupling

The patented flexible chain coupling here illustrated has been designed by the engineers of the Baldwin-Duckworth Chain Corporation, 367 Plainfield St., Springfield, Mass., to provide for free operation or flexibility without friction and excessive noise. This is accomplished by the use of special double-width roller chains. One strand of the chain is equipped with the standard cylindrical rollers, whereas the other strand has convex oversize rollers which provide for free operation in cases where shaft deflection and misalignment exist.

Permanent shaft deflections up to 3 degrees can be taken care of without undue strains, thus compensating for temporary misalignment or permanent eccentricity of shaft joints.



National Acme Die-head for B & S Automatics

## National Acme Circular-Chaser Die-Heads for B&S Automatics

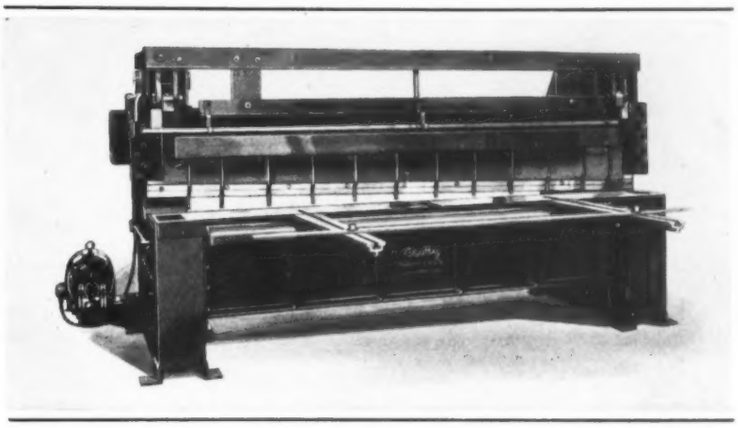
A new line of self-opening die-heads, with either milled- or ground-thread circular chasers, for use on Brown & Sharpe automatics, has been announced by the National Acme Co., Cleveland, Ohio. These tools are hardened and ground throughout, and are of the pull-off type, with safety release. The design is a radical departure from the die-head described in January, 1933, MACHINERY, page 363, although somewhat similar in appearance. The new tool has been shortened considerably; and instead of the usual adjusting ring on the bottom side of the body for adjusting the pitch diameter, this adjustment is now accomplished by means of two screws.

A new device is also provided for tripping the die. This is in the form of a combination spring latch and opening device which permits taking the die apart. The new safety release, built into the die proper, allows a positive pull-off with safety. This die-head is furnished for all sizes of Brown & Sharpe automatics taking a minimum range of 0.056 inch up to the maximum Brown & Sharpe automatic cutting size. The new die is made considerably heavier than previous designs and can be operated at higher speeds.

The die-head is of a special alloy steel, heat-treated, and precision-ground. The chasers are mounted externally, so that the cutting action does not take place inside of the die-head

proper. The chips are thrown outward and do not interfere with the free operation of the tool, making it possible to thread close up to a shoulder.

Either straight or tapered threads can be cut. The removal of one screw permits the operator to slip each block, with its chaser out of the head for regrinding. Each chaser is sharpened while mounted on its block and then checked for accuracy with a micrometer gage before placing it in the die-head. Right- or left-hand threads can be cut.



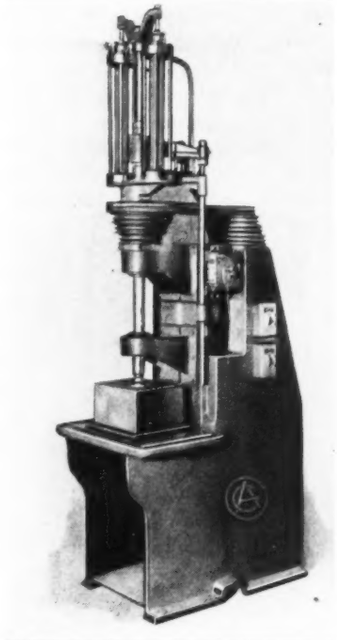
Beatty Button-controlled Plate Shear

## Giern & Anholtt "Carbideborer"

The "Carbideborer" announced by the Giern & Anholtt Tool Co., Inc., 1312 Mt. Elliott Ave., Detroit, Mich., is built to utilize tungsten-carbide tools for both rough- and finish-boring operations. The roughing and finishing can be done simultaneously. The machine has a double V-belt drive and hydraulic feed, with provision for slow, fast, or jump feed, and automatic return. No gears are employed, and it is claimed that this feature tends to prevent vibration and chatter.

The stroke in this model is 18 inches, and the feed can be varied from 0 to 0.315 inch per minute. The boring capacity ranges from 3/4 inch to 2 1/2 inches in diameter. The spindle pulley is mounted independently in ball bearings, and the spindle proper is fed through rotary bushings, the drive being accomplished by means of a floating key.

The boring tool or bar fits the No. 4 Morse taper in the spindle nose and is guided through either one or two rotary bushings, depending on the depth of the hole to be bored. It is claimed that this method of supporting the tool prevents vibration and provides adequate support for the tool throughout the full length of the stroke.



"Carbideborer" for Boring Operations with Tungsten-carbide Tools

## Beatty All-Steel Totally Enclosed Plate Shear

Instantaneous cutting action at the touch of a button, for cutting singly or for continuous cutting, is a feature of the plate shear recently announced by the Beatty Machine & Mfg. Co., Hammond, Ind. This shear is built in a number of sizes and is of all-steel construction, with all working parts fully enclosed.

The push-button control eliminates the foot-treadle, thus providing a safety feature. As shown in the illustration, no flywheel is employed. This permits the machine to be operated instantly at any time by simply pressing the control button, and eliminates the necessity for running the motor between operations. The machine is designed to give a clear view of the work, and large or small sheets can be sheared within full view of the operator. An adjustable end-squaring gage is provided, which has a range of 2 inches from the blade to any specified width.

## Skilsaw Portable Electric Drill

A portable electric drill having a capacity for drilling 5/8-inch holes in steel has been added to the line of portable drills made by Skilsaw, Inc., 3310 Elston Ave., Chicago, Ill. This new tool is of larger capacity than the portable drill described in June, 1934, MACHINERY, page 638. The motor of the new drill is of the universal type operating on direct or alternating current, 60-cycle or less, and at all voltages ordinarily available. The armature is statically and dynamically balanced, and the field and armature windings are baked in Bakelite and varnish.

The drill is housed in a die-cast aluminum-alloy body, a feature that gives greater strength and lighter weight. It is equipped with ball bearings throughout, and with gears and shafts of heat-treated alloy steel. The free speed is 500 revolutions per minute. The weight is 15 pounds.

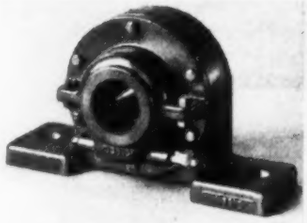


Fig. 1. Fafnir Floating Pillow Block

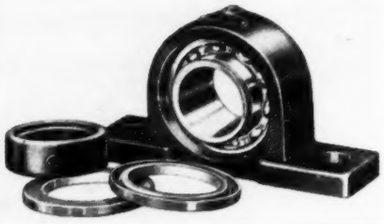


Fig. 2. Fafnir Light-duty Ball-bearing Pillow Block

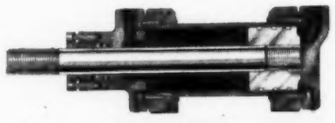
## Fafnir Ball Bearings with New Mountings

The Fafnir Bearing Co., New Britain, Conn., has recently placed on the market four new types of ball bearings that have mountings designed to meet various requirements. The Type SAOL high-temperature floating pillow block, shown in Fig. 1, has been designed for use where variation in temperature produces shaft expansion and contraction. One bearing is mounted in a self-aligning ring at one end of the shaft, so that it is free to move slightly in the housing and is not locked in any one position. This allows for expansion or deflection of the shaft from heat or other causes. The bearing for the opposite end of the shaft is mounted similarly, although in a fixed position. The bearings themselves are fitted with twice as much lateral play as the standard bearings, to allow for high-temperature operation.

The light-duty SAK type pillow block, shown in Fig. 2, has been developed for use where unusual ruggedness is not necessary, but where low cost is of first importance. While a standard duty bearing is housed in this unit, its over-all dimensions have been reduced to a minimum.

Another new Fafnir product is a take-up unit for conveyor equipment in which it is necessary to take up the slack in either a belt or chain. The wide inner-ring type ball bearings used are mounted in a special housing that has slots cut in both the bottom and top, which permit the housings to be moved along the supporting rails.

A take-up eccentric ball-bearing pillow block is another unit recently developed by this company. While designed primarily for cotton-seed oil machinery, this unit has also been adapted to various mechanical shakers, such as those employed in coal handling and grain milling.



Cross-section of Hannifin Hydraulic Cylinder

## Hannifin Double-Acting Hydraulic Cylinders

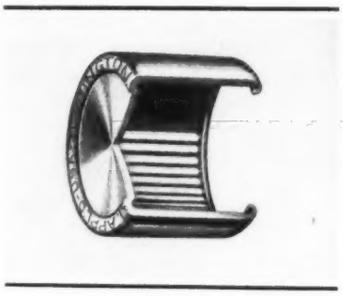
A new line of double-acting cylinders for high-pressure hydraulic service has recently been introduced by the Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago, Ill. A sectional view of one of the cylinders is shown in the accompanying illustration. These cylinders are available with numerous types of mountings, as well as in a wide range of sizes, and with practically any length of stroke required. The standard models are designed for working pressures up to 1500 pounds per square inch. Special cylinders can be furnished for higher pressures.

A noteworthy feature is the elimination of all tie-rods. The cylinder caps can be removed without disturbing the mounting, thus facilitating replacement of gaskets and the inspection of internal parts. The caps can be turned so that the inlet port is located at the top, bottom, or either side. Air vent plugs are provided on all four sides of each cap, so that there is always an air vent plug on the top or upper side. These cylinders are also available either with a small-diameter piston-rod or with a 2 to 1 differential of the piston area. In the latter case, the area of the piston on the piston-rod side is substantially one-half the area of the larger side. This is an important feature where the same reciprocating speed is required in both directions of travel.

## Weather-Proof and Dust-Tight Safety Switches

A line of weather-proof, dust-tight, Type A safety switches made in standard sizes from 30 to 600 amperes capacity is now being supplied by the Electric Controller & Mfg. Co., 2708 E. 79th St., Cleveland, Ohio. These switches are equipped with a fully interlocked door, making it impossible to operate the switch with the door open or to open the door with the switch closed. Dustproof, enameled cabinets are used to enclose the switches. A heavy sponge rubber gasket makes a tight seal between the door and the cabinet.

E C & M Type A Safety Switches



Torrington Closed-end Type Needle Bearing

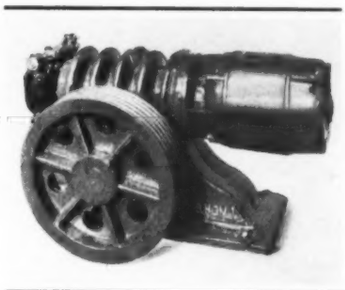
## Torrington Closed-End Needle Bearing

The closed-end needle bushing shown in the accompanying illustration is a recent addition to the line of needle bearings made by the Torrington Co., 55 Field St., Torrington, Conn. Like the regular line of Torrington needle bearings, described in September, 1934, MACHINERY, page 56, the new bushings or bearings have a large number of needle-like rollers. The small diameter of the rollers permits the bushings to be made with outside diameters comparable to those of bronze and babbitt bushings. With the exception of the closed end, the bearing here illustrated is the same as the type previously described.

The use of the closed-end bushing is, of course, more or less obvious. The one-piece outer shell raceway, being closed on one end, serves to retain the lubricating oil or grease. Needle bearings of this kind are regularly made with bore diameters of from 1/2 to 1 3/4 inches. The outside diameter ranges from 11/16 inch to 2 1/8 inches, and the length from 1/2 inch to 1 1/2 inches.

## Worm Type Powered Gear Used as a Hoist

The compact hoist unit here illustrated was developed recently by Foote Bros. Gear & Machine Co., 5301 S. Western Blvd., Chicago, Ill., for raising and lowering the stage curtain of a large auditorium. Later applications of the same type of unit have been made advantageously in individual hoists for raising and lowering elevators and material-handling equipment.



Foote Bros. Worm Type Powered Gear Hoist

The unit consists of a standard HGM worm type powered gear unit with a solenoid brake mounted on the extended worm-shaft and a grooved drum on the slow-speed worm-gear shaft. The simple adaptation of the brake and drum to a standard IXL worm type powered gear reduction unit of this company's manufacture results in a compact drum hoist. The exclusive "radiating" feature of the IXL worm type powered gears consists of heat-radiating corrugations on the worm housing, which provide for quick dissipation of the generated heat.

This equipment can be furnished in either horizontal or vertical types. A complete range of ratios is available, which provides driven shaft speeds from 0.55 to 600 revolutions per minute. Capacities range from 3/4 to 40 horsepower. Units having smaller motors are available.

## Ajax Electrical Ammonia Dissociator

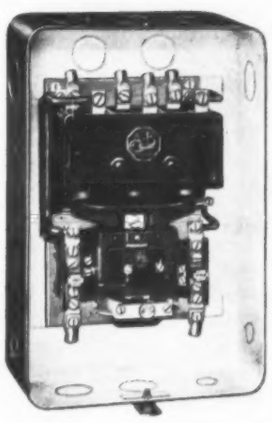
An ammonia dissociator has been brought out by the Ajax Electric Co., Inc., Frankford Ave. and Allen St., Philadelphia, Pa., which is designed to give an economical and reliable source of gas containing 75 per cent hydrogen and 25 per cent nitrogen for such operations as bright annealing, copper brazing, silver soldering, radio tube manufacturing, hydrogenation of oils, automatic hydrogen welding, aluminum welding, lead burning, and the reduction of oxides of tungsten, molybdenum, etc. This ammonia dissociator is heated electrically and is automatic in operation. There are no moving parts to clean and oil.

Anhydrous ammonia enters the dissociator as a liquid, is vaporized, the pressure reduced, and then dissociated into its component parts—hydrogen and nitrogen. Dissociation is accomplished by passing the anhydrous ammonia gas through a bed of catalytic material, heated by electric heaters, and vaporizing the liquid anhydrous ammonia by the heat from the previously dissociated gas.

## Allen-Bradley Solenoid Switch

Solenoid-operated starting switches of 50- and 100-ampere ratings have been added to the line of equipment manufactured by the Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis. These two new switches will handle polyphase currents for motors up to 15 horsepower, 110 volts; 30 horsepower, 220 volts; and 50 horsepower, 440-550 volts.

These switches can also be used for starting single-phase



Allen-Bradley Solenoid Switch with Cover Removed

motors that may be connected across the line. A cabinet cover, not shown in the illustration, is completely removable. A feature of these switches is the patented arc hood which completely encloses each contactor and prevents arcing or heated gases from escaping and causing flashovers.

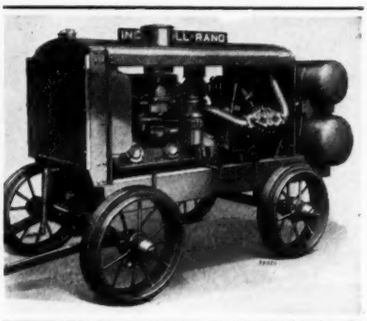
## Brown & Sharpe Clamp for Dial Indicators

The Brown & Sharpe Mfg. Co., Providence, R. I., has brought out a new clamp attachment, No. 734A, for use with dial test indicators Nos. 730 and 733. This clamp has a maximum capacity of 2 3/4 inches in diameter, and can be quickly attached to the arbor, spindle, or similar machine part, so that the dial gage can be used for accurately checking the setting of fixtures and vises. It can be used with the indicator to check the squareness of the spindle in a drill press and for similar work. The brass shoe on the end of the bolt is made with a swivel to prevent injury to a finished surface.

B & S Clamp Attachment for Use with Dial Test Indicators

## Ingersoll-Rand Portable Air Compressor

A new two-stage, air-cooled portable air compressor known as the Model 85 has been added to the line of portable machines built by the Ingersoll-Rand Co., 11 Broadway, New York City. This compressor is driven by a Waukesha gasoline engine and has a capacity of 85 cubic feet of air per minute at a pressure of 100 pounds. The compressor has two low-pressure and one high-pressure air-cooled cylinders and an air-cooled intercooler.

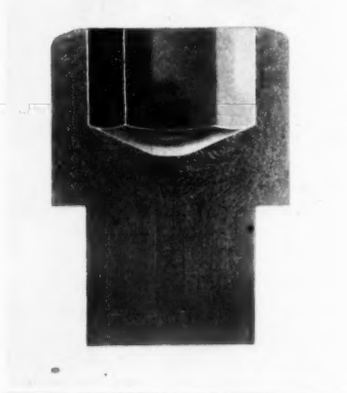


Ingersoll-Rand Model 85 Portable Air Compressor

It is claimed by the manufacturer that this compressor will show a saving of fuel cost up to 25 per cent over the fuel cost for the water-cooled single-stage type portable compressors. The two-stage feature also gives increased efficiency over the single-stage units at high altitudes and in hot climates.

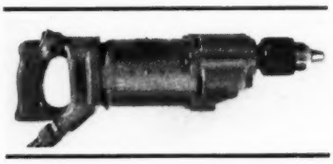
## "Fibro" Forged Socket Screw

The Holo-Krome Screw Corporation, Bristol, Conn., announces a new socket screw to be known by the trademarked name "Fibro Forged Screw." The method employed in the manufacture of these screws results in continuous uncut fibers that are neither severed nor broken from one end of the screw to the other, as shown in the accompanying cross-sectional view. The method of producing these screws is patented by the manufacturers in the United States and Great Britain.



Cross-section of "Fibro" Forged Socket Screw

The continuous fiber structure obviously gives increased strength in those portions of the screw where strength is most needed. A feature of the screws is the accurate socket, which is uniform in size for the full depth of the hole. The socket is also of true hexagonal shape with smooth, regular walls and well defined corners.



No. 31 Hercules High-frequency Electric Drill

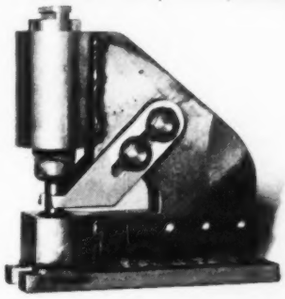
## Hercules High-Frequency Electric Drill

The No. 31 Hercules high-frequency electric drill recently brought out by the Buckeye Portable Tool Co., Dayton, Ohio, is equipped with the new Hercules cool-running, high-frequency motor. This general-purpose drill is obtainable with a side handle and switch, as well as in the spade-handle design illustrated.

The motor operates on three-phase, 180-cycle current at 225 volts, and also on 110 volts. The speed is 800 revolutions per minute. The drill is equipped with a 3/8-inch Jacobs chuck. The over-all length is 15 1/4 inches, and the weight 10 1/2 pounds.

## Semco "Multi-Unit" Punches

A line of "Multi-Unit" punches designed primarily for use in presses or press brakes in place of the usual multiple punching attachment has been placed on



"Multi-Unit" Punch for Use on Presses in Any Number Required

the market by the Service Machine Co., 161 Miller St., Elizabeth, N. J. The accompanying illustration shows a close-up view of a single No. 4 Multi-Unit. The units can be readily clamped in the press with any center spacing required without the necessity for realigning each punch and die. All units are standardized, so that extra units can be added when necessary.

Pratt & Whitney or Cleveland punch couplings are used to hold the interchangeable punches. The punches are removed by simply unscrewing the coupling. Adjustable back gages and adjustable strippers of sturdy construction are supplied. Adapters on the bottom surface of the unit and tongues on the piston can be machined to suit the press in which they are to be used.

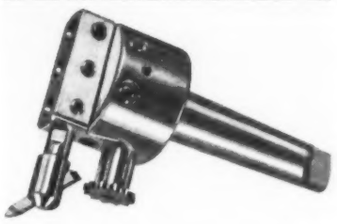
Spring-return units can be supplied where direct connection to the ram of the press is not desirable. All sizes and types of units are alike in the essential dimensions, such as the height from the bottom to the die bushing and the over-all height. Thus, units of different sizes can be mounted together. The units are made with two depths of throat—namely, 4 and 6 inches, which cover a range of punch sizes from 5/16 to 3/4 inch in diameter.

## Craley Boring, Turning, and Facing Head

A boring, turning, and facing head designed to bore and face work up to 13 inches in diameter and to turn the outside diameter of studs or bosses up to 4 1/2 inches in diameter has been placed on the market by the C. C. Craley Mfg. Co., P. O. Box 192, Shillington, Pa. This boring head can be used on milling, boring, or drilling machines where the work remains stationary.

The head of the tool has four openings, 3/4 inch in diameter, for the boring and turning tools. Three of these openings are in the front end of the block. Each opening extends the whole depth of the block, and the tools are held by three socket-head screws.

The adjusting screw has 40 threads per inch. The barrel is graduated in thousandths of an inch, and has a star wheel on the outer end to permit adjusting while the head is revolving. The barrel can also be adjusted by hand with a socket-head wrench inserted in the broached opening in the end of the star wheel. The sliding block has an adjustment

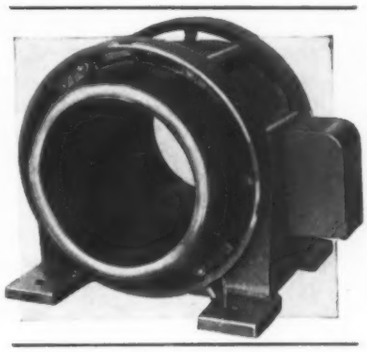


Boring, Turning, and Facing Head Made by C. C. Craley Mfg. Co.

of 1 inch right or left of the zero position, for either hand or power feed.

## Allis-Chalmers "Seal Clad" Motors

Permanent coil protection is a feature of the new "Seal Clad" squirrel-cage motors which are being introduced on the market by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. These new motors are built in ratings up to 25 horsepower, 1800 revolutions per minute, and are designed for a broader range of application



Stator Coils of "Seal Clad" Motor Protected by Bakelite Shields

than the ordinary open motor. Hard, smooth, Bakelite shields are sealed over the stator coils, giving protection against metallic dust, grit, oil, moisture, mild acids, and other agents that are injurious to insulation. The frames of these open-type motors are of cast steel and the stators are designed to resist unusually heavy distortion stresses. The rotors are silver-brazed. Oil- and dust-tight sleeves or anti-friction bearings are used.

* * *

## The British Machinery Industry

According to a report from Vice-Consul Wallace E. Moessner, Manchester, England, issued through the Machinery and Agricultural Implements Division of the Bureau of Foreign and Domestic Commerce, the conditions in the British machinery industry are, in general, favorable. Considered as a whole, the industrial machinery manufacturing branches continue to show a considerable improvement. Production in general has been speeded up, and during the past year there has been a substantial increase in the number of people regularly employed. Increased exports amounting to about 20 per cent, as compared with a year ago, have contributed materially to the recovery.

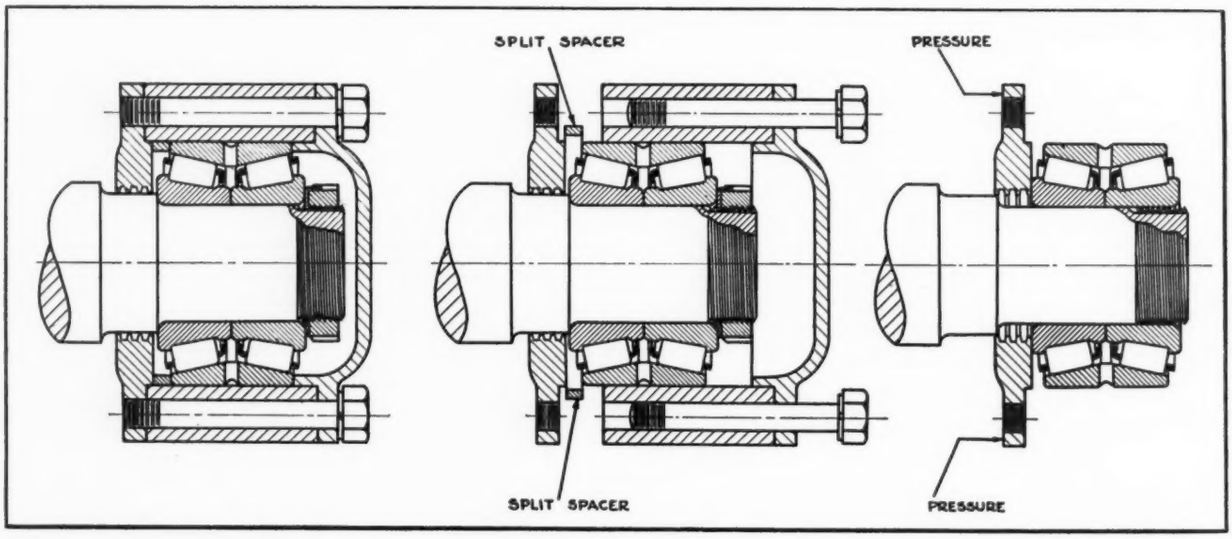
Perhaps the most active demand has been for various types of machine tools, particularly precision grinding machines and gear-cutting equipment.

## Stripping Non-Adjustable Roller Bearings from the Shafts

In the Type NA Timken tapered roller bearing, which is a non-adjustable unit designed especially for applications where it is not desirable to provide means for bearing adjustment in service or where operating conditions require a fixed mounting at one end of an assembly and some degree of "float" at the other, certain fits must be observed in order to obtain the proper running clearance, which is established at the time of manufacture. A two-row bearing of this type is shown at the left in the illustration, mounted in a solid housing. The cones are pressed in place with a tight fit, the inner cone seating against a shoulder on the shaft. The abutting cone faces are ground at the factory to provide the proper running clearance. The cup is located in the assembly by means of a split spacer ring on the inner end and a follower on the cover plate on the outer closure.

This type of bearing has been on the market for about two years, and during this period the company has received a number of inquiries as to how the bearing can be removed from the housing and shaft for inspection or salvage. The accompanying drawings were made to indicate the proper method of removing bearings of this type.

The central diagram illustrates the first step in removing the bearing. When the through bolts are loosened, the outer cover plate and bearing housing can be stripped off easily. This releases the split spacer ring. The lock-nut and tongued washer that clamp the cone to the shaft are next removed, and after the split spacer ring has been taken off, the inner closure plate can be brought forward into contact with the inner face of the inner cone. As both cones are in contact, continued application of pressure on the inner closure plate will slide the entire bearing assembly off the shaft smoothly, as indicated in the right-hand view, and with a minimum of force. Pressure should be applied to the cones only, because if pressure is applied through the cup, the resultant forces acting through the tapered rollers will tend to hold the bearing in place.




Diagrams Illustrating the Proper Method of Stripping Timken Type NA Bearings from Shafts

* * *

The recently evidenced willingness of Government and business to consolidate their common desire and activities for the promotion of recovery on a realistic basis, is the most favorable augury for progress to that end in the year 1935. With all the improvements in prospect, it is yet unreasonable to expect that 1935 will fully bridge the gap between depression and recovery; but there is substantial reason for the belief that the groundwork is being laid for a progressive return to prosperous times.—*F. A. Merrick, president, Westinghouse Electric & Mfg. Co.*

## Soviet Purchases in the United States

According to the *Economic Review of the Soviet Union*, orders placed by the Amtorg Trading Corporation in the United States during the first nine months of the year totaled $8,669,000, a gain of over 170 per cent, as compared with the same period in 1933. Of these purchases, automotive and aerial transport equipment accounted for $4,731,000, and industrial equipment for $2,161,000. Apparently the Soviet Union is now able to furnish practically all its requirements in agricultural equipment, since the purchases in this branch amounted to only $68,500.

Sales of Soviet products in this country by the Amtorg Trading Corporation during the first eight months of the year totaled $8,633,000. The close agreement between the value of our sales to the Soviet Republics and our imports from them is significant. It is obvious that if we will buy, we can sell.

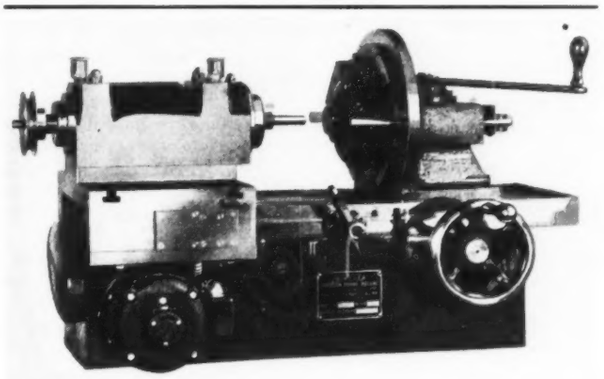
It may be of interest in this connection to record the figures covering Soviet-British trade. During the first eight months of the year, the total amount of orders placed in Great Britain amounted to $33,000,000, of which $4,600,000 was for machinery and equipment.

* * *

Every dollar spent by the Government has had to be worked for and earned by somebody first.

## Precision Boring of End-Shields

Motor end-shields of about a dozen different styles are being accurately bored in the armature-shaft bushing by means of the machine here illustrated, which was recently built by the Stokerunit Corporation, 5325 W. Rogers St., Milwaukee, Wis. These motor end-shields are of two basic flange diameters. The previously turned



Machine Made for the Precision Boring of the Armature-shaft Bearing in Motor End-shields

flange is seated accurately in hardened and ground rings of the special chuck mounted at the right-hand end of the bed. Hooks that are operated and locked by means of the fixture crank-handle clamp the motor end-shield securely in position.

Tolerances of minus 0.0000 inch and plus 0.0002 inch are maintained. The bore is interrupted on one side by a large opening that is provided for an oil wick. The bearing is bored 5/8 inch in diameter for some of the end-shields and 13/16 inch for others.

In this operation, the table is traversed by hand toward the tool-spindle until the work is positioned approximately for starting the cut. Then the motor is started for feeding the table automatically during the actual boring. The motor is stopped automatically at the end of the cut. When the fixture hooks are loosened after the table has been returned to its starting position, plungers in the fixture eject the work.

The hole bored in this operation is inspected on a mandrel. It must be true within 0.001 inch as regards concentricity and squareness.

* * *

## Treatment for Concrete Floors

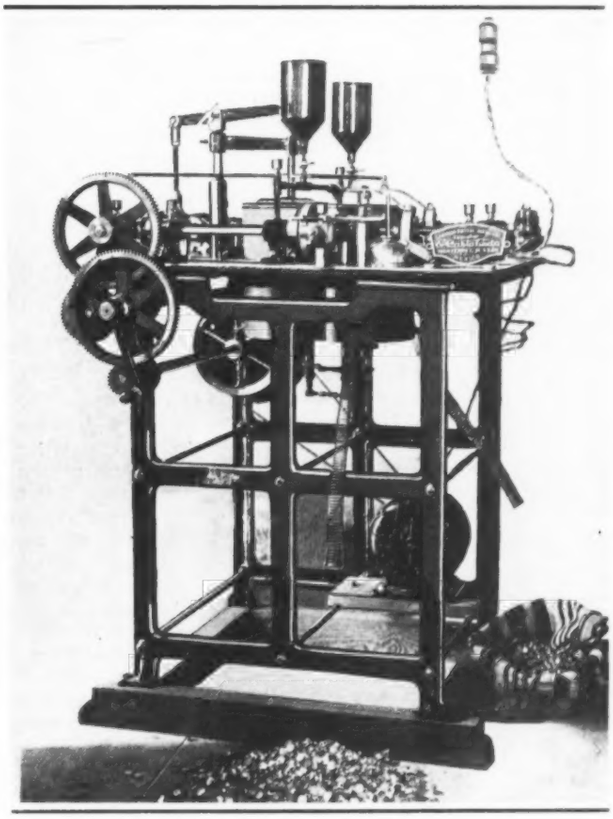
A recently developed treatment for concrete floors is claimed to produce a very hard surface and to possess many advantages over methods formerly used. This treatment has been developed by the Stonhard Co., 401 N. Broad St., Philadelphia, Pa. It is said not only to penetrate concrete floor surfaces so as to weld the cement and aggregate into a solid mass, but it is also a vehicle for a solid that fills and seals the surface pores, eliminating thereby the pockets that hold disintegration agents.

## Lead Seals Die-Cast at High Speed

Lead seals of the kind used the world over for sealing mail pouches, express packages, freight car doors, etc., are die-cast at the rate of 6000 an hour in the machine here illustrated. As this machine is fully automatic, one man can tend a battery of four or five. His work consists of refilling the melting pot once every thirty minutes. The machine is built by E. Castaneda, Calle De Tapia, 1708 Pte., Monterrey, N. L., Mexico.

In this machine, the lead is melted in a cast-iron pot, either by a gas flame or electrically. A plunger is intermittently lowered into the molten metal to raise its level so that it can overflow through a notch in the rim of the melting pot and into the gate of the mold. The pieces are automatically ejected as they harden. Multiple molds are used to obtain high rates of production.

In addition to being used for seals of various descriptions, the machine can be employed for casting lead heads on roofing nails and for producing many other parts of various shapes and sizes.



Die-casting Machine Designed to Produce One Hundred Small Lead Seals a Minute

* * *

## An Alice-in-Wonderland Ruling

The ruling of the Regional Labor Board for New York, New Jersey, and Connecticut, that concerns may not move to more favorable locations without taking with them their labor agreements and their employes, would seem to attach manufacturers to the soil much as Russian serfs formerly were.—*Commerce and Finance*

# NEWS OF THE INDUSTRY

## California

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J., has recently established a Pacific Coast regional headquarters at Los Angeles, Calif., which will center jurisdiction and development of the corporation's business in the western territory now covered by the offices in Seattle, San Francisco, Los Angeles, and El Paso. C. E. WILSON, vice-president, is in charge of this Pacific Coast Division and has moved his office from New York to 510 W. 6th St., Los Angeles.

## Illinois and Michigan

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill., is completing an extension to its Milwaukee plant at 244 S. 19th St., which will almost double the former warehouse capacity of the plant. The plant proper has been extended to almost twice its former length. A section of the old warehouse has been insulated and rebuilt with a new central heating system for the storage of special steels. A new two-story modern brick office building with sound-deadening ceiling and other improvements, has also been erected.

The company announces that Permite leaded bronze bearing stock is now available in bar lengths up to 6 feet. These longer lengths make possible the speed production of bearings and bushings on a lathe or screw machine.

HARDINGE BROS., INC., Elmira, N. Y., has established an office at 544 W. Washington Blvd., Chicago, Ill. The new quarters are centrally located and have proper space for the display of the precision bench lathes, milling machines, hand screw machines, and collets made by the company. HENRY C. LAUX and EDWARD A. IVERSON will be in charge.

HARRY A. MEYERS, formerly vice-president of the Dean Machinery Co., 80 E. Jackson Blvd., Chicago, Ill., has been elected president, succeeding R. S. DEAN, who severed his connection with the company several months ago. HARRY A. LYON has been elected vice-president.

UDYLITE CO., Detroit, Mich., announces that the company has the exclusive rights to manufacture, sell, and use ball and spheroidal anodes for electroplating, these rights being based upon United States Patent Reissue 19328, covering ball anodes for electroplating and containers for them, which has recently been granted by the Patent Office. The Udylite Co. first introduced ball anodes to the plating industry as part of the Udylite process of cadmium-plating several years ago. Most of the firms engaged in cadmium-plating are now using ball anodes. This type of anode is also being increasingly used in other electroplating processes, such as copper, zinc, tin, etc.

DEVLIEG MILLING MACHINE CO., Jackson, Mich., has appointed the CADILLAC MACHINERY CO., Detroit, Mich., representative of the company in the Detroit territory.

## New England

GAMMONS-HOLMAN CO., Manchester, Conn., manufacturer of Gammons spiral reamers and special fine cutting tools, has declared to all employes a Christmas bonus of 1 per cent of the total year's earnings of each individual. This company reports a definite improvement in business in 1934, and its statistics show that there has been an average increase of $275 in the yearly wages per man over 1933. This wage increase is due entirely to better business and additional working hours, rather than to code requirements, for the company has steadfastly maintained its wage standards over a long period of years.

RALPH E. FLANDERS, president of the Jones & Lamson Machine Co., Springfield, Vt., who was recently elected president of the American Society of Mechanical Engineers, has been awarded by the Society the Worcester Reed Warner gold medal for his "contributions to a better understanding of the relationship of the engineer to economic problems and social trends." This medal was established by the will of the late Worcester Reed Warner of the Warner & Swasey Co., who was one of the founders of the Society and an honorary member.

PRODUCTION MACHINE CO., Greenfield, Mass., has purchased the entire business, good will, etc., of the PEERLESS SURFACING MACHINE CO., INC., Troy, N. Y., and has moved the business to the Greenfield, Mass., factory of the company. The Peerless surfacing machines will continue to be manufactured under the name of the Peerless Surfacing Machine Co. Division of the Production Machine Co.

M. L. ECKMAN, formerly engineer for the Federal Machine & Welder Co., and for many years prominently associated with the welding industry, has been chosen to head the research and development department of the Thomson-Gibb Electric Welding Co., with headquarters at Lynn, Mass.

HENRY PELS & CO., INC., 90 West St., New York City, announce the appointment of the AUSTIN-HASTINGS CO., ParKett Machinery Division, 226 Binney St., Cambridge, Mass., as distributor for the New England territory.

## New York

CLARENCE E. DAVIES, since 1931 executive secretary of the American Society of Mechanical Engineers, has been appointed secretary of the Society, succeeding Calvin W. Rice, whose death in October this year terminated twenty-seven years of active service as the Society's secretary. Mr. Davies is a graduate in mechanical engineering of the Rensselaer Polytechnic Institute, 1914. Previous to his connection with the American Society of Mechanical Engineers, he was employed at the Smith Premier Works of the Remington Typewriter Mfg. Co., Syracuse, N. Y. In 1920, he became associate editor of the Journal of the American Society of Mechanical Engineers, and in 1921, managing editor and assistant secretary of the Society.

DAVID M. CURRY has joined the development and research staff of the International Nickel Co., Inc., 67 Wall St., New York City. Mr. Curry was associated for eleven years with the Ford Motor Co. as assistant superintendent of foundry departments. He was later with the Federal Mogul Corporation of Detroit in charge of all foundry activities, and in recent years has carried on an extensive consulting practice in the Middle West. He will make his headquarters in New York and will devote his time to development work in the non-ferrous casting field, covering the entire range of foundry operations.

A. BAIR BASSOFF, formerly production engineer of the Worth Steel Co., and more recently consulting engineer of the Sier-Bath Co., has been appointed executive engineer of the S-B Gear Corporation, 640 W. 58th St., New York City, who will shortly place a complete line of speed reducers on the market. Mr. Bassoff will have complete charge of the development, design, and production of the S-B Gear Corporation's products. In addition, he will continue his connection as consulting engineer of the Sier-Bath Co.

FRED J. WALLS has recently been added to the development and research staff of the International Nickel Co., Inc., 67 Wall St., New York City. Mr. Walls will concentrate on the development of the use in industry of nickel cast irons, including the wear-resistant nickel-chromium cast iron "Ni-Hard," and the high-strength cast iron "Ni-Tensyliron." He will be concerned chiefly with problems in the automotive and machine tool fields.

J. L. OSGOOD MACHINERY & TOOL CO., INC., Buffalo, N. Y., announces that,

owing to the increasing demand for its line of indestructible file and tool handles, the company has decided to operate the handle department as a subsidiary under the name of the J. L. OSGOOD HANDLE CO. All communications regarding this end of the business should be addressed to the subsidiary at 43-45 Pearl St., Buffalo, N. Y.

EARL V. SNYDER has been appointed district manager for New York State (with the exception of New York City) of the L. H. Gilmer Co., Tacony, Philadelphia, Pa., manufacturer of industrial belts and belting for power transmission. Mr. Snyder was formerly identified with the American Engineering Co., the Babcock & Wilcox Co., and the International Motor Co.

OSTER-WILLIAMS, Cleveland, Ohio, manufacturers of pipe and bolt threading equipment, have opened an office and display room at 292 Lafayette St., New York City. H. B. Van Osten, New York district manager, will have charge of the new office.

CHARLES MCKNIGHT, of the International Nickel Co., Inc., 67 Wall St., New York City, was elected chairman of the committee on ferro-alloys at a recent meeting of the American Society for Testing Materials.

HOWARD U. HERRICK, formerly president of the V & O Press Co., Hudson, N. Y., took up his duties as vice-president of the E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn, N. Y., on December 1.

CLIMAX MOLYBDENUM CO., announces the removal of its offices from 295 Madison Ave. to 500 Fifth Ave., New York City.

## Ohio

REPUBLIC STEEL CORPORATION, Youngstown, Ohio, has appointed the following new warehouse distributors of Enduro stainless steel: BUHL SONS CO., Detroit, Mich.; the F. W. HEITMANN CO., Houston, Tex.; and the WOODWARD CO., Albany, N. Y. The company also announces the appointment of the STEEL PRODUCTS CO., McKees Rock, Pa., as warehouse distributor of Toncan iron sheets in the Pittsburgh area.

HARRY W. MCQUAID, of the Republic Steel Corporation's metallurgical staff, addressed the local chapter of Mining and Metallurgical Engineers, University of Minnesota, Minneapolis, December 11, on the subject, "The Effect on Finished Products of Raw Materials in Steel Making." Mr. McQuaid is an internationally known authority on steel, having been the co-originator of the McQuaid-Ehn grain size test. He maintains his headquarters at the Republic's Central Alloy Division, Massillon, Ohio.

CHARLES M. PACK has rejoined the Doehler Die Casting Co., Toledo, Ohio, as assistant to the president, in charge of all research and development. For the last few years Mr. Pack has been acting as a consulting engineer and metallurgist.

## Pennsylvania and New Jersey

BROWN INSTRUMENT CO., Philadelphia, Pa., announces a consolidation of the company with the MINNEAPOLIS-HONEYWELL REGULATOR CO., Minneapolis, Minn. The Brown Instrument Co. will continue to function as a separate company with its existing organization, but as a subsidiary of the Minneapolis-Honeywell Regulator Co. Richard P. Brown will remain president of the Brown Instrument Co. and will become an officer and director of the Minneapolis-Honeywell Regulator Co. The sales and service facilities will be continued from the present main office and factory at Philadelphia.

L. H. GILMER CO., Tacony, Philadelphia, Pa., announces that in order to take care of its expanding V-belt and "Kable Kord" belt business, an increase in space facilities is required. For the last year, three eight-hour shifts have been operated, and the point has now been reached when this procedure is no longer adequate, so that additional groups are being put to work. The increased space required is available in the Gilmer factory.

THOMAS T. WATSON, who joined the metallurgical department of the Lukens Steel Co., Coatesville, Pa., in August, 1931, has been appointed development and service metallurgist. He will be engaged principally in service and sales work in connection with Lukens Nickel-Clad steel.

ALLAN SEYMOUR, sales engineer of the Grinding Wheel Division of the Norton Co., Worcester, Mass., has been appointed manager of the Philadelphia office. RALPH M. JOHNSON, who has been district manager, takes over Mr. Seymour's duties in Worcester as sales engineer.

WILLIS H. CARRIER, a well-known pioneer in the air-conditioning field, has been awarded the medal of the American Society of Mechanical Engineers for 1934 "in recognition of his research work in air conditioning." Mr. Carrier is chairman of the board of the Carrier Engineering Corporation, the Carrier Corporation, and the Carrier Mfg. Corporation of Newark, N. J., and of the Carrier Engineering Co., Ltd., of London, England. He is a past-president of the American Society of Refrigerating Engineers and of the American Society of Heating and Ventilating Engineers. As a pioneer in air conditioning, he is the author of many scientific papers, one of which, "The Rational Psychometric Formulae," published in 1911, presented the theory now accepted on the evaporation of moisture.

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***Willis H. Carrier, Recently Awarded the A. S. M. E. Medal***

Mr. Carrier was born in Angola, N. Y., in 1876, and was graduated from Cornell in 1901 with the degree of electrical engineer.

DR. LEO HENDRIK BAEKELAND, inventor of Bakelite resinoid and president of the Bakelite Corporation, 247 Park Ave., New York City, was awarded the honorary degree of Doctor of Applied Sciences during the recent Centenary Celebration of the University of Brussels in Brussels, Belgium.

* * *

## New Method and Equipment for Dynamic Balancing in the Field

A new method for the dynamic balancing of heavy rotating machinery in the field under normal operating conditions, and new portable equipment for obtaining a direct and exact solution of this problem, have been developed by the General Electric Co., Schenectady, N. Y. The new balancing method will meet the growing need for a simple balancing procedure for heavy rotating machinery without disassembling the machinery and taking it to a balancing machine.

Both the new method and equipment for its application were described by Ernest L. Thearle of the General Electric Research Laboratory at the annual meeting of the American Society of Mechanical Engineers in New York early in December. The company has also developed a balancing machine adapted to the rapid and accurate balancing of small rotors on a production basis.

# NEW BOOKS AND PUBLICATIONS

PRINCIPLES OF MECHANISM. By C. E. Pearce. 283 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $3.50, net.

This book has been written primarily for college sophomore classes in mechanism. It is assumed that the students have no great familiarity with various kinds of machinery. The material presented and the order of arrangement are based upon the experience of the author in teaching classes in mechanism for many years. The text is divided into fourteen chapters, treating of the following subjects: Machines in General; Transmission by Direct Friction Contact; Transmission by Toothed Wheels; Transmission by Screw Gears; Transmission by Flexible Connectors—Belts; Transmission by Flexible Connectors—Ropes and Chains; Transmission of Intermittent Motion; Transmission by Trains of Wheels—Ordinary Type; Transmission by Trains of Wheels—Planetary Type; Vector Representation of Motion; Transmission by Linkages; Transmission by Cams; Mechanisms with Some Special Geometrical Property; Formation of Gear Tooth Outlines.

THE SELECTION AND REPLACEMENT OF MANUFACTURING EQUIPMENT. By Paul T. Norton, Jr. 35 pages, 6 by 9 inches. Published by the Virginia Polytechnic Institute, Blacksburg, Va.

This treatise, published as a Bulletin of the Virginia Polytechnic Institute, comprises a discussion of the economic factors involved in the selection and replacement of manufacturing equipment. The author, who is professor of industrial engineering at the Virginia Polytechnic Institute, has covered the subject in an interesting and comprehensive manner. He first points out that much equipment in use today is obsolete and that replacement through definite planning is necessary. He then develops formulas that may be used in solving the replacement problem, and deals with the expected return on invested capital, depreciation, and obsolescence in a manner that indicates a thorough study of the subject. Numerous examples of machine selection and replacement are given.

WHO PAYS? By Ernest Greenwood. 301 pages, 5 by 8 inches. Published by Doubleday, Doran & Co., Garden City, N. Y. Price, $2.

The appalling loss of life and limb each year due to preventable accidents demands a careful study of the causes of such accidents and the means of preventing them. Mr. Greenwood, in his new book, presents the results of such a study in an interesting and forceful manner. According to authoritative data, prepared by insurance companies, governmental agencies, the National Safety Council, etc., the cost of our national carelessness is 1,300,000 lives and ten billion dollars a year.

The first half of the book, entitled "Who Pays?" contains an analysis of the causes of accidents occurring on the road, in the home, and in industry. The second part of the book, entitled "The Answer," contains definite and constructive suggestions for preventing the various classes of accidents referred to. This book should be of great educational value, and cannot fail to impress the thoughtful reader with a sense of his own responsibility in eliminating some of this unnecessary waste of life and cause of human suffering.

MECHANICAL CATALOG (1934-1935). 311 pages, 8 1/2 by 11 1/2 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

This is the twenty-fourth annual edition of a comprehensive compilation of mechanical catalogue data, including an index to manufacturers of industrial equipment, materials, and supplies. The index lists 665 different firms under 4000 classifications. This book is an important aid to those who buy or specify for industry. It also supplies engineers with a knowledge of products for preliminary plans and lay-outs, and serves as a handy substitute for manufacturers' catalogues when they are not on file and as a ready index when they are. There is an index to the catalogue material, arranged alphabetically according to the name of the manufacturer, which includes a brief statement of the origin of the company, its activities, and line of products.

AUTOMOBILE FACTS AND FIGURES. 96 pages, 6 by 9 inches. Published by the Automobile Manufacturers' Association (formerly the National Automobile Chamber of Commerce), 366 Madison Ave., New York City.

This is the 1934 edition of a very useful handbook on the automobile industry, giving statistical information on the manufacture and use of motor vehicles. It contains figures on production since the beginning of the automobile industry in this country, monthly production for recent years, vehicle registrations in different states and cities, together with a great deal of other statistical data pertaining to the industry—employment, wages, taxes, etc. Statistics on motor vehicles in different countries and highway statistics are included.

PRACTICAL EVERYDAY CHEMISTRY. By H. Bennett. 305 pages, 5 1/2 by 8 1/4 inches. Published by the Chemical Publishing Co. of New York, 175 Fifth Ave., New York City. Price, $2.

This book will be of interest and value to the layman who desires to gain some knowledge of chemicals, so that he can make various products for himself. It is not intended to be a text-book on chemistry, but contains a vast number of formulas and recipes for transforming a few simple ingredients into lacquers, lubricants, polishes, soaps, waxes, drugs, inks, cosmetics, beverages, and hundreds of other products. Besides being useful to the layman, the manufacturer may find in these formulas new ideas and uses for his products.

# COMING EVENTS

JANUARY 5-10—New York Automobile Show, at the Grand Central Palace, under the auspices of the Automobile Merchants' Association of New York, Inc. Alfred Reeves, show manager, Madison Ave. at 46th St., New York.

JANUARY 14-18—Annual meeting of the Society of Automotive Engineers to be held at the Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary, 29 W. 39th St., New York City.

MARCH 3-10—Leipzig Trade Fair, Leipzig, Germany. For further information, address Leipzig Trade Fair, Inc., 10 E. 40th St., New York City.

MARCH 5-8—Fifth Packaging Exposition to be held at the Palmer House, Chicago, Ill., under the auspices of the American Management Association. The exposition will cover packaging, packing, and shipping. For further information address Roberts Everett Associates, Inc., 232 Madison Ave., New York City, managers of the exposition.

JUNE 19-21—Summer meeting of the American Society of Mechanical Engineers to be held in Cincinnati, Ohio. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

JULY 15-20—International Congress for Scientific Management in London, England. For further information, address Industrial Development Association, British Empire Bldg., 620 Fifth Ave., New York City.

SEPTEMBER 11-21—Machine Tool Exposition to be held in Cleveland, Ohio, under the auspices of the National Machine Tool Builders' Association, 1220 Guarantee Title Bldg., Cleveland, Ohio.

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## It gives—The Flexibility of Control of the "Column and Knee Design"

(quick set-ups—reduction in non-productive time)

## Combined with—The Production Advantages of the "Bed Type Milling Machine"

(unusual rigidity—high production with accuracy)

. . . . an economical investment for both short and long run production jobs

Investigate its advantages—Brown & Sharpe Mfg. Co., Providence, R. I., U.S.A.

**BROWN & SHARPE**

**No. 22 PLAIN MILLING MACHINE**

## Charles S. Lockwood Completes Sixty Years with Hyatt

On the evening of December 18 the executive staff and department heads of the Hyatt Roller Bearing Co., Newark, N. J., gave a testimonial dinner to Charles S. Lockwood, who has just completed sixty years of continuous service

with the John Wesley Hyatt's several enterprises, forty-two years of which have been with the Hyatt Roller Bearing Co.—that is, ever since the formation of the company. At the dinner, nearly one hundred Hyatt men were present, many of whom had been associated with Mr. Lockwood for more than 25 years.

Mr. Lockwood, who is now eighty-three years old, went to work in 1874 as a young man in his twenties in the Newark experimental laboratories of Mr. Hyatt. He had the unusual privilege to work for many years side by side with Mr. Hyatt, whose inventive genius is well known. In the sixty years that have passed since then, upward of one hundred patents have been issued to Mr. Lockwood. This is indicative of the important part that he has played in the various Hyatt experimental and production activities.

In 1892, the Hyatt Roller Bearing Co. was formed to build and sell the roller bearings that bear the inventor's name. After a few years, Mr. Hyatt, who was then over seventy, retired from active service, and Mr. Lockwood carried on in charge of the Hyatt Roller Bearing Experimental Laboratories. Today, a few months from his eighty-fourth birthday, Mr. Lockwood, still hale and hearty, is an active member of the experimental staff. It is significant that it is difficult for him to discuss the past, because he is so keenly interested in the present and in the future.

# OBITUARIES

## Joseph A. Shelly

Joseph A. Shelly, instructor at the Dickinson High School in Jersey City, and well known to past readers of MACHINERY as a contributor of articles on pattern shop practice, died recently. Mr. Shelly was born in Brooklyn, where he attended public schools and the St. Francis Academy. Later, he studied at Pratt Institute and St. Johns College in Brooklyn and at the New York University and Fordham College in New York. He also took a course at the Oswego State Normal School at Oswego, N. Y. He devoted the latter part of his life to teaching woodworking and mechanical drawing. For fifteen years he was instructor in the Evening School of Science and Technology at Pratt Institute in Brooklyn, and later, for nineteen years, in the Jersey City schools.

Mr. Shelly had the ability to express himself clearly and concisely on technical subjects in writing, and his book "Patternmaking," published in 1923 by MACHINERY, is still recognized as the outstanding book on patternmaking in the English language. Those who read MACHINERY some twelve years ago will also recollect the numerous articles on patternmaking practice that were published at that time.

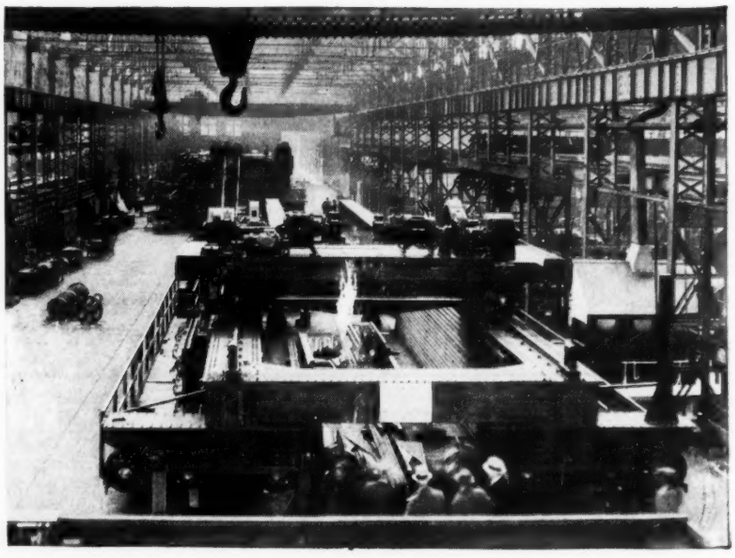
Mr. Shelly had an unusual personality. He made friends wherever he went, and his capabilities in his work, no less than his fine personal characteristics, made him honored and esteemed by all who came in contact with him.

## James R. Vandyck

James R. Vandyck, president of the Vandyck-Churchill Co., New York City, dealers in machine tools and shop equipment, died suddenly at his home in Hackensack, N. J., December 12, at the age of sixty-three years. He had become ill in his New York office the same day and had returned to his home early in the afternoon.

Mr. Vandyck formed the J. R. Vandyck Co. in 1901, and three years later, following an expansion of the business, he became president of the Vandyck-Churchill Co. During the World War period, Mr. Vandyck was associated with the War Trade Board and supervised export shipments of all classes of machinery, machine tools, and shop equipment. He was prominent in the machine tool trade, and at the time of his death was secretary of the Associated Machine Tool Dealers of the United States and chairman of the Board of Regional Supervisors of the Machine Tool Dealers Division of the NRA. He was also a former president of the Machinery Club of New York.

He is survived by his widow, Isabel Wightman Vandyck, and two brothers, Edward Bogert Vandyck of Philadelphia and Hendrick Alden Vandyck of New York City.



***Part of a shipment of four huge 300-ton electric cranes built by the Harnischfeger Corporation for the United States Government for installation at Boulder Dam. These cranes have a 64-foot span and a lift of 70 feet. The eight electric motors used on the bridge drive have a combined capacity of 410 horsepower for each crane. These cranes will be used for handling mammoth 600-ton hydro-electric rotor generators, the largest of their kind ever built.***